



# ESSENTIALS

OF

# OBSTETRICS

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## PREFACE TO THE SECOND EDITION.

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As set forth in the preface to the first edition the object of this work is to place the *Essential* facts and principles of *Obstetrics* within easy grasp of the student. It is intended as an introduction to the more elaborate treatise, and as a guide in following the didactic and the practical teaching of the college course.

Most attention has been given to practical topics. Theoretical discussions, matters of merely historical interest and elaboration of details have in the main purposely been excluded.

Works of this character, in the author's experience, have, within their proper limits, a distinct value in medical teaching. The pupil in any department of learning needs first to master its elements. This once accomplished, a complete and systematic knowledge of the subject becomes a matter of comparatively easy growth.

The present edition represents a complete revision of the work. Much has been rewritten and new matter has been added.

The author will be gratified if the book in its revised form meets with the flattering reception accorded the first edition.

CHARLES JEWETT.

330 CLINTON AVE., BROOKLYN, N. Y.,  
October, 1901.



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### ERRATA.

- Page 22. Kobalt should read Kobelt.  
Page 192. Gauge should read gauze.  
Page 192. Forbe's should read Forbes'.  
Page 193. Sterilized gruel should read dextrinized  
gruel.  
Page 194. (Sugar two tablespoonfuls) should read  
sugar (two tablespoonfuls).

# ESSENTIALS OF OBSTETRICS.

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## CHAPTER I.

### ANATOMY OF FEMALE GENITAL ORGANS.

FOR convenience of description the genital organs of the female may be divided into the external and the internal genitals, and the vagina, which connects the one group with the other.

The external genitals of the female together constitute the *pudendum*, all but the mons veneris, the *vulva*.

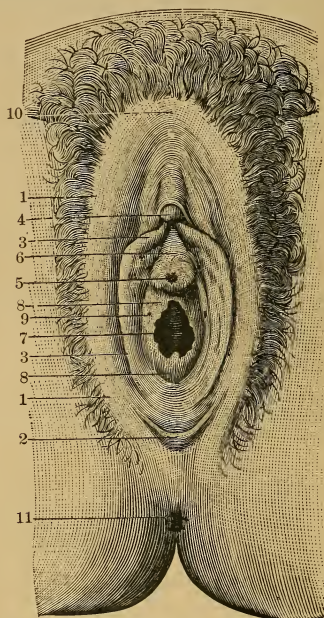
#### **External Genitals.**

The external sexual organs of the female are the mons veneris, the labia majora, the labia minora, the clitoris and the hymen.

**The Mons Veneris**, or the mount of Venus, is the fleshy prominence which overlies the anterior aspect of the pubic bones. Its surface is slightly convex. It is bounded laterally by the groins, above by the hypogastric fold, and below it merges into the labia majora. It consists essentially of fat supported by a reticular framework of fibrous and elastic tissue. Fibers of elastic tissue, some of which are derived from the superficial abdominal fascia, run through the adipose layer in all directions. The round ligament may be traced into the mons on either side. Its integument, which is somewhat thicker than that of the

abdomen, becomes invested at puberty with a growth of short, crisp, curly hair ; it abounds in sebaceous and in sweat glands. The hairy growth extends an inch or more

FIG. 1.



Vulva of the virgin. 1. Greater lip of right side. 2. Fourchette. 3. Small lip. 4. Clitoris. 5. Urethral orifice. 6. Vestibule. 7. Orifice of the vagina. 8. Hymen. 9. Orifice of the vulvo-vaginal gland. 10. Anterior commissure of greater lips. 11. Anal orifice.

above the level of the pubic bones. It is a peculiarity of the female that the hair of the pubic region is limited above by a sharply defined straight or convex line.

**The Labia Majora**, or larger lips, are two prominent rounded folds springing from the mons veneris and extending downward and backward on either side of the median line. At full development they lie in contact with each other in the young nullipara, except when the thighs are strongly abducted—*vulva connivens*. When shrunk from loss of fatty tissue in old age, or from the effects of childbirth, the labia minora protrude between them—*vulva hians*. They are thickest in front, and taper from before backward. The point of contact in front is spoken of as the anterior, and that behind as the posterior commissure of the vulva. There is, however, no true commissure in the sense of a connecting band at either point.

The covering of the labia majora is skin. The outer surfaces, which are of a somewhat darker color than the surrounding integument, are supplied with hair which is most abundant anteriorly; the inner surfaces resemble mucous membrane, but are sparsely covered with fine hairs. Both surfaces abound in sebaceous and in sweat-glands. Their internal structure consists chiefly of elastic and adipose tissue, and includes a rich venous plexus. Immediately beneath the skin is a layer of smooth muscular fibers analogous to those of the dartos in the male. Within this is the pudendal sac. It is made up of elastic fibers, and is attached by its neck to the external inguinal ring. Its fundus reaches nearly to the posterior vulvar commissure. Its cervix contains elastic and adipose tissue. The remains of the canal of Nuck may sometimes be traced into the pudendal sac. Each round ligament of the uterus terminates in the corresponding labium. The labia majora are the analogue of the scrotum in the male.

**The Labia Minora**, or **Nymphæ**, the smaller lips, are two thin folds of delicate skin lying between the labia majora. They are widest toward their anterior extremities, narrowing gradually from before backward. When at rest their inner surfaces are in contact. The outer surfaces merge into the labia majora, the inner are continuous with the vestibule. Anteriorly each subdivides into two subsidiary folds. The superior folds join in front of the clitoris to form the prepuce, the inferior unite and are attached to the under surfaces of the glans to form the frænum of the clitoris. Posteriorly they are united by the fourchette.

In Bush women and in many Hottentots the smaller labia are hypertrophied, reaching half-way to the knees; this overgrown structure is known as the Hottentot apron.

In the virgin the nymphæ present the appearance of mucous membrane; after long exposure from gaping of the vulva they look like skin. They are destitute of hairs and of sweat-glands. Sebaceous glands are found on both surfaces. In general the histological characters of the outer surfaces are those of skin, not of mucous membrane. The minute anatomy of the inner surfaces lies between that of skin and mucous membrane.

The internal structure of the nymphæ includes some bundles of unstriped muscular fiber and a superficial capillary venous plexus, but no fat.

The labia minora are richly supplied with nerve fibers.

**The Fourchette**, or **Frenulum Vulvæ**, is a transverse fold of skin immediately in front of the posterior vulvar commissure. It is scarcely apparent, except when put upon the stretch by separating the labia. It then appears as a tense transverse fold between the posterior com-

missure and the hymen. In the nulliparous woman its distance from the anal orifice is 3 cm.,  $1\frac{1}{4}$  inch; from the base of the hymen nearly 1 cm.,  $\frac{1}{3}$  inch.

**The Fossa Navicularis** is a boat-shaped space which appears between the hymen and the fourchette when the labia are separated.

**The Rima Pudendi** is the median cleft between the labia of the right and the left sides.

**The Clitoris** is situated in the median line below the anterior vulvar commissure. It is a very small cylindrical body, and is slightly curved with its convexity outward. It has two corpora cavernosa and a glans analogous to those of the penis, but has no corpus spongiosum, and is imperforate. Continuous with the corpora cavernosa are the crura by which the clitoris is attached to the ischio-pubic rami. The body is attached to the pubic bones by the suspensory ligament. It is concealed behind the skin and is enclosed in a firm fibrous sheath. Its internal structure is made up chiefly of erectile tissue. The only visible portion of the organ is the glans, and this lies partly concealed in the preputial fold formed by the anterior layers of the nymphæ as has already been stated. During erection the glans has a thickness of about 5 mm. The entire length of the clitoris is about one inch. Its mucous membrane is richly supplied with nerve papillæ.

**Arteries and Vein.**—It has two arteries, the dorsal and the profunda, and a dorsal vein. The vascular supply is from the pudic artery. The dorsal vein empties into the vesical plexus and communicates freely with all the surrounding venous plexuses.

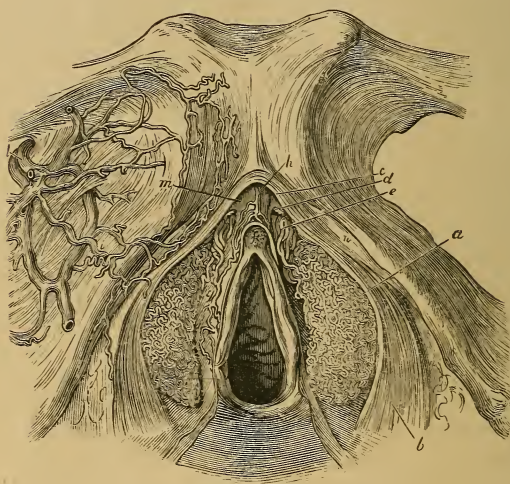
**The nerve-supply** is derived from the internal pudic and from the hypogastric plexus of the sympathetic, and is four

or five times more abundant than that of the penis. The clitoris is the chief seat of voluptuous sensation in the female.

**Glands.**—A few sebaceous follicles are to be found on the glans.

**The Vestibule.**—This is the triangular surface bounded laterally by the labia minora and below by the margin of

FIG. 2.



The bulbi vestibuli. (After KOBALT.)

the vaginal orifice. Its covering is mucous membrane. At its apex is the glans clitoridis. Immediately above the middle of its base is the meatus urethræ. This appears as a small tubercle or prominence with a median cleft. The meatus lies 2 cm.,  $\frac{3}{4}$  inch, below the glans clitoridis, and 2.5 cm., 1 inch, above the fourchette,



in the nullipara. An intricate plexus of veins immediately underlies the mucous membrane. This is the *pars intermedia*, so called from the fact that it connects the opposite vestibular bulbs with each other and with the veins of the clitoris.

**The bulbi vestibuli** are two leech-shaped masses of veins about 3.5 cm. in length, and are situated one on either side of the mesial line behind the labia, opposite the vaginal orifice and the base of the vestibule. In extent they reach from the level of the posterior margin of the vaginal orifice nearly to the clitoris. They lie between the bulbo-cavernosus muscle and the vaginal wall, immediately in front of the triangular ligament. They communicate freely with the veins of the labia, the vagina, the perineum, the glans clitoridis, and with other neighboring venous plexuses. Each is enclosed in a fibrous sheath. Their internal structure comprises, in addition to venous plexuses and connective tissue, some smooth muscular fibers. The bulbs correspond to the bulbs of the urethra in the male.

**The Vulvo-vaginal Glands, Glands of Bartholin or Duvorney.**—These are the analogues of Cowper's glands in the male. They are two reddish-yellow bodies varying in size from a pea to an almond, lying one on each side of the posterior portion of the vaginal orifice, between the layers of the triangular ligament, sometimes anteriorly to both. They are partly covered by the lower extremities of the bulbi vestibuli. Their ducts, about 1.3 cm.,  $\frac{1}{2}$  inch, in length, run along the inner aspects of the bulbi vestibuli, opening just without the base of the hymen at the sides of the vaginal orifice. The secretion, which is a yellowish tenacious mucus, is poured out freely under sexual excitement and during labor.

**The Hymen.**—The hymen usually appears as a septum, partially occluding the vaginal orifice when the labia are drawn apart. When at rest it protrudes as a loose fold in the vulvar fissure. According to Budin, it is a thinned-out fold of the vaginal wall. Its most common form is that of a crescent, situated at the posterior margin of the introitus, with its concavity looking forward. It may, however, be annular, or may occupy the entire vaginal orifice, being either imperforate or cribriform—perforated with holes—or may have a single central opening with a fimbriated edge. Its histological characters are similar to those of the vaginal wall, yet it has but few muscular fibers. It is usually torn at the first sexual approaches. An untorn hymen is not, however, an infallible mark of virginity, nor is a torn one necessarily evidence that sexual intercourse has been practised.

**The Carunculæ Myrtiformes.**—The carunculæ myrtiformes are the remnants of the hymen torn in labor by the passage of the child. They appear as minute fleshy tubercles, three or four in number, skirting the vaginal orifice or at least its posterior margin.

#### **Vessels, Lymphatics, and Nerves of the Pudendum.**

**Arteries.**—The arterial supply of the pudendum is derived from the superficial perineal branches of the internal pudic and from the external pudic artery.

**Veins.**—The veins accompany the arteries. They form large plexuses and empty into the internal pudic and the inferior branch of the small sciatic. Varicosities are common during pregnancy. The venous plexuses of the labia become turgid during sexual excitement.

**Lymphatics.**—The lymphatics go mainly to the super-

ficial inguinal glands, which in turn communicate with the internal or with the external inguinal glands.

**Nerves.**—The nerve supply, which is abundant, is from the superficial perineal nerve, which is given off from the pudic, the inferior pudendal nerve, which comes from the small sciatic, and from the inferior hypogastric plexus of the sympathetic.

### The Vagina.

The vagina is that part of the genital tract between the uterus and the pudendum. Its direction is nearly parallel with the plane of the pelvic brim. It terminates below in the hymen or its remnants; the upper part of the tube, which surrounds the cervix, is the roof or fornix of the vagina. The part of the upper extremity behind the cervix is the posterior, that in front the anterior fornix; the lateral portions of the vaginal roof are spoken of as the lateral fornices. The posterior is deeper than the anterior fornix, owing to the higher attachment of the posterior vaginal wall to the cervix.

**Relations.**—As already stated, its upper extremity is attached to the uterine cervix a little below the middle of its length, the lower portion of the cervix projecting into the vagina nearly at a right angle. The posterior wall for about one-fourth of its length is in relation at the vaginal roof with the retro-uterine fold of peritoneum, the cul-de-sac of Douglas. Its lower end is united with the so-called perineal body; at its middle portion, over about half its length, it is connected with the rectum by a loose connective tissue. The upper part of the anterior wall is loosely attached to the bladder; the lower half is intimately connected with the urethra, the latter being incorporated in it.

Laterally the fornices are in relation with the bases of the broad ligaments ; below the fornices the vagina is attached on either side to the levator ani fascia.

**The recto-vaginal septum.**—The united portions of the rectal and the posterior vaginal walls form the recto-vaginal septum.

**The vesico-vaginal septum** is formed by the union of the posterior wall of the bladder with the anterior vaginal wall.

**The urethro-vaginal septum** is the partition between the urethra and the vagina.

**The Shape** of the vagina when distended is approximately that of a truncated cone with its larger end up. When at rest it is a collapsed tube, the anterior lying in contact with the posterior wall. Its cross-section in the adult presents the shape of an H, the limbs of which have a slight inward convexity. Its orifice, the *introitus vaginae*, is nearly circular. The vaginal axis is approximately a straight line.

**The Size** of the vagina is larger in women who have practised sexual intercourse than in virgins, and is much increased in child-bearing women.

The length of the anterior wall in the virgin is 6.3 cm.,  $2\frac{1}{2}$  inches, that of the posterior wall 9 cm.,  $3\frac{1}{2}$  inches, or a little more. The walls, however, are extremely distensible, and in parous women they become permanently enlarged and relaxed, sometimes attaining the length of 10 to 12 cm., 4 to  $4\frac{3}{4}$  inches. The width of the canal at the widest part is about 4 cm.,  $1\frac{5}{8}$  inch, in the virgin ; in women who have borne children it is frequently 7 cm.,  $2\frac{3}{4}$  inches.

**Structure.**—The vagina has three coats : the external or fibrous coat ; the middle or muscular coat ; the internal coat or mucous membrane.

1. The fibrous coat is a prolongation of the recto-vesical fascia.

2. The muscular coat consists of an inner circular and an outer longitudinal layer of unstriped muscular fibers. It is thickest near the vaginal orifice, thinnest in the upper part of the vagina. A band of voluntary muscular fibers, the bulbo-cavernosus muscle, encircles the vaginal orifice.

3. The mucous coat is of a light pink color. It presents two median ridges, one on the anterior and one on the posterior wall. Transverse ridges, *cristæ*, run outward on either side from the longitudinal ones. The median columns with the transverse *cristæ* are known as the *columnæ vaginæ*. These structures are more marked on the anterior than on the posterior wall, and on both are most conspicuously developed near the vaginal orifice. They are rarely found at all above the lower two-thirds of the tube. They are more or less completely effaced by child-bearing and by catarrhal inflammation of the vagina. The mucous membrane of the lower portion of the vagina lies in loose folds when the canal is closed. Its surface is studded with papillæ. The epithelium is of the squamous variety.

**The arterial supply** of the vagina is chiefly from the vaginal artery. The upper extremity of the tube receives branches from the uterine and the lower from the pudendal artery. These vessels anastomose with one another and with the vesical and rectal arteries. They all spring from the anterior division of the internal iliac.

**The veins** correspond, but they first form plexuses entirely around the canal, one in the external coat and one in the submucous layer of connective tissue. They com-

municate with the hemorrhoidal, vesical, pudendal and pampiniform plexuses. None of these veins has valves.

**The Lymphatics.**—The lymphatics of the lower fourth of the vagina join with those of the pudendum, terminating in the inguinal glands. Those from the remaining portion of the vagina unite with those from the cervix uteri and empty into the internal iliac glands.

**The nerves** are derived from the fourth sacral and the pudic of the spinal system, and from the lower hypogastric plexus of the sympathetic.

**Glands.**—The existence of true secreting glands, mucous glands, is by most anatomists denied. The vaginal secretion has an acid reaction, due to the presence of an acid-producing bacillus.

**The Urethra.**—Intimately connected with the lower portion of the anterior vaginal wall is the urethra. Though not a generative organ, it is of obstetric interest, and is therefore described.

**Situation.**—From the midpoint of the base of the vestibule the urethra passes backward beneath the pubic arch to the bladder. In the lower three-fourths of its length it is embedded in the anterior vaginal wall. It is supported by the pubo-vesical ligament, and it pierces the layers of the triangular ligament in the same manner as does this canal in the male. The portion of the canal between the layers of the triangular ligament is encircled by the compressor urethræ muscle. The general direction of the canal is nearly parallel with the pelvic brim.

**Shape.**—Its shape is straight or very slightly curved, with its convexity downward and backward. When at rest its mucous membrane lies in longitudinal folds which are especially marked at the upper extremity. Its meatus

is a vertical slit ; its vesical end is not funnel-shaped, as sometimes described ; the canal terminates abruptly in the bladder.

**Size.**—The length of the urethra is about 4 cm.,  $1\frac{5}{8}$  inch, its average diameter is 6 mm.,  $\frac{1}{4}$  inch. It is largest at the vesical end, smallest at the meatus, and is very distensible.

**Structure.**—It has two muscular coats, an outer circular and an inner longitudinal layer and a mucous membrane.

The epithelium of the urethral mucosa in the lower portion of the tract is of the squamous type ; toward the upper extremity it is of the transitional form, like that of the vesical mucous membrane.

**The vascular and the nervous supply** are the same as those of the vestibule. There is a plexus of large veins around the canal, and another plexus between the two muscular coats.

**Glands.**—Numerous lacunæ and racemose glands are to be found on the surface of the mucous membrane. There are two tubular glands, known as Skene's glands, three-fourths of an inch in length, in the wall of the urethra near its floor, one on either side of the median line. Their orifices lie just within the meatus urethræ.

### Internal Genitals.

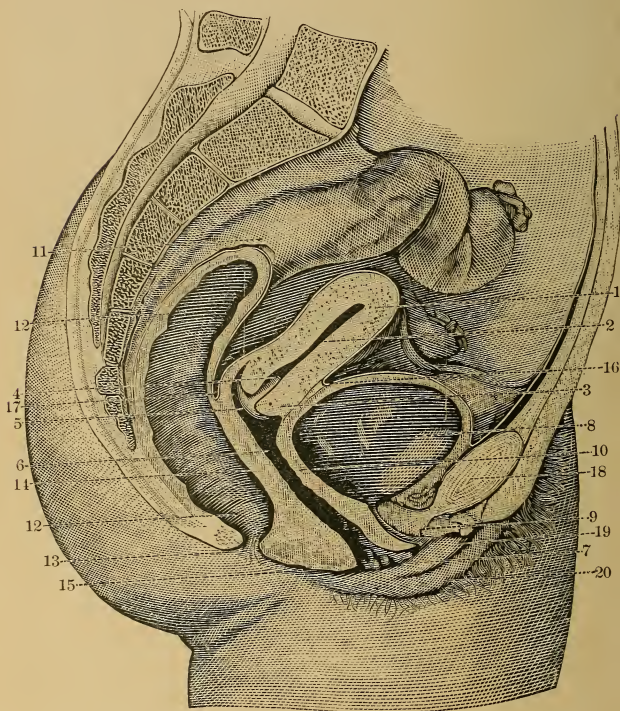
These include the uterus, the Fallopian tubes and the ovaries.

**The Uterus. Situation.**—In the erect position of the woman the uterus is situated in the cavity of the pelvis, between the bladder and the rectum, a little nearer to the sacrum than to the pubic bones. When the bladder and



rectum are empty its upper border is nearly in the plane of the pelvic brim, its lower border just above the level of a

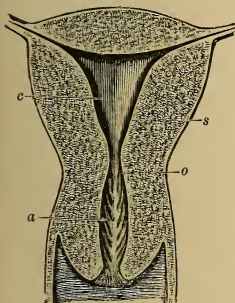
FIG. 3.



Sagittal section of the pelvis, showing relations of generative organs. 1. Body of the uterus. 2. Cavity. 3. Neck. 4. Cavity of the neck. 5. Intra-vaginal part of the neck. 6. Vagina. 7. Vaginal orifice. 8. Bladder. 9. Urethra. 10. Vesico-vaginal wall. 11. Rectum. 12. Rectal cavity. 13. Anus. 14. Recto-vaginal wall. 15. Perineum. 16. Vesico-uterine cul-de-sac. 17. Utero-rectal cul-de-sac. 18. Pubic symphysis. 19. Small lip. 20. Great lip.

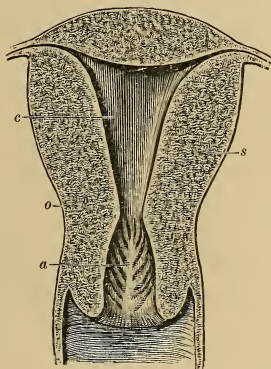
line drawn from the lower end of the symphysis pubis to the tip of the sacrum, or in the plane of the ischial spines and posterior to a central position. The average direction of its long axis is nearly perpendicular to the plane of the pelvic brim. Its position, however, is variable within normal limits. A full bladder pushes it bodily back toward the sacrum and tilts the fundus backward. A dis-

FIG. 4.



Section of the nulliparous uterus, showing shape of corporeal and cervical cavities, etc.

FIG. 5.



Section of parous uterus, showing shape of corporeal and cervical cavities, etc.

tended rectum displaces it forward. The upper portion of the uterus is in relation with the small intestines. The latter sink into the upper part of the utero-sacral space and sometimes into the utero-vesical pouch. Posteriorly the uterus is separated from the rectum by a fold of peritoneum, which dips down into the pelvic cavity to the distance of an inch or more below the cervico-vaginal junction. This retro-uterine pouch of peritoneum will be described

more fully later. Anteriorly the peritoneum covers about two-thirds the length of the uterus. That portion of the lower third of the uterus between the vagina and the peritoneum is attached to the bladder by loose connective tissue. The lower uterine extremity projects into the upper end of the vagina to the extent of nearly 1.3 cm.,  $\frac{1}{2}$  inch. The axis of the uterus forms approximately a right angle with that of the vagina when the former organ is in its usual normal position. Laterally the uterus is in relation with the broad ligaments, presently to be described.

**Shape.**—The uterus is a hollow muscular body. Its shape is pyriform with its larger end uppermost. It is slightly flattened from before backward, its posterior and its upper surfaces are convex, its anterior aspect nearly flat. Its long axis is straight or slightly curved, with its concavity forward.

**Size.** (a) *Nulliparous uterus.*—The average measurements of the nulliparous uterus are 2.5 cm., 1 inch, nearly, in thickness antero-posteriorly, 3.8 cm.,  $1\frac{1}{2}$  inch, in width at the level of the Fallopian tubes, and 6.3 cm.,  $2\frac{1}{2}$  inches, in length.

(b) The *parous uterus* is approximately 2.5 cm., 1 inch, thick, 5 cm., 2 inches, wide, and 7.5 cm., 3 inches, long. The transverse thickness of the lower end of the uterus, the cervix, is 3.1 cm.,  $1\frac{1}{4}$  inch. The organ undergoes marked atrophy after the menopause.

**Weight.**—The nulliparous organ weighs about 28 grams, 1 ounce; in the parous woman the weight is 43 grams,  $1\frac{1}{2}$  ounce.

**Regional Divisions.**—The uterus presents two principal divisions, the body and the cervix.

The *body* is approximately the upper half of the uterus in the nulliparous, the upper two-thirds in the parous woman.

The *isthmus* is the slight constriction at the junction of the body and the cervix.

The *fundus* is that part of the body above the level of the Fallopian tubes.

**Divisions of the Cervix.**—(a) The *infra-vaginal portion*, or *portio vaginalis*, is that part of the cervix below the vaginal roof. Its average length in the parous woman is 1 cm., a little less than  $\frac{1}{2}$  inch.

(b) The *supra-vaginal portion* is that part between the portio vaginalis and the isthmus. Its length in the woman who has borne children is 1.5 cm., a little more than  $\frac{1}{2}$  inch.

**Uterine Cavity.**—(a) The cavity of the body is somewhat triangular in shape in the nullipara, its anterior and posterior walls lying practically in contact. It has three openings, one communicating with the cervical canal and one with each of the Fallopian tubes.

(b) The cavity of the cervix is slightly flattened from before backward, and is laterally elliptical, thus having an irregular fusiform shape.

The *os internum* is the upper orifice of the cervical canal, and is about 2.5 mm.,  $\frac{1}{10}$  inch, in diameter.

The *os externum*, or *os tincæ*, is the lower orifice, a little larger than the os internum.

**Structure.**—The *mucous membrane of the body* of the uterus is about 1 mm.,  $\frac{1}{25}$  inch, thick at the fundus and more than twice that thickness at the center of the body. No folds are to be observed in the mucosa of the body of the uterus except, perhaps, at the mouths of the Fallopian

tubes. Its epithelium is of the ciliated columnar variety, the cilia, as stated by most anatomists, propelling toward the tubes. According to recent observations of Hofmeier,<sup>1</sup> the ciliary movement is toward the external os. The mucosa of the body is firmly attached to the muscular structures. It abounds in tubular glands, many of which are bifurcated—the utricular glands. These are slightly tortuous, and, with few exceptions, extend to the muscularis; some of them penetrate it. Generally their direction is oblique to the mucous surface. They are lined with ciliated epithelium. Their secretion is alkaline. Dr. A. W. Johnstone ascribes to the corporeal endometrium a glandular character comparable to that of the lymph-tissues in the walls of the alimentary canal and of other adenoid structures.

*The mucous membrane of the cervix* is thicker, firmer, and paler than that of the body, and it is united to the muscularis by a distinct submucous layer of loose connective tissue. On the anterior and on the posterior wall it presents a pinnate arrangement of ridges known as the *arbor vitæ* or *palmæ plicatæ*. This consists of a median longitudinal ridge from which well-marked lateral processes run outward and upward. Upon and between the ridges of the *arbor vitæ* are numerous racemose glands which are histologically mere inversions of the mucous membrane. In the upper two-thirds of the canal the epithelium on the crests of the transverse ridges of the *palmæ plicatæ* is ciliated. Elsewhere on the free surface it is goblet-shaped, without cilia.

The gland-cells are cuboidal and non-ciliated. The epithelium of the lower third of the cervical canal and of the

<sup>1</sup> Centralb. f. Gyn., 1893, No. 33.

entire external surface of the portio vaginalis is squamous, like that of the vagina. The secretion of the cervical glands is a clear tenacious mucus having an alkaline reaction.

*The muscularis* constitutes the greater part of the thickness of the uterine walls. Its fiber is of the unstriped variety. The muscular wall is usually described as consisting of three layers; but this division into strata cannot be made out except during gestation, and even then the layers are not distinctly separable.

The outer layer, which is very thin, consists chiefly of longitudinal fibers which are continuous with the muscular layers of the Fallopian tubes, the ovarian, round, and uterosacral ligaments.

The middle layer comprises the bulk of the uterine muscle and is a meshwork of interlacing longitudinal and circular bundles.

The inner layer, which is made up of circular bundles, is extremely thin. It surrounds the orifice of the Fallopian tubes and forms a sphincter at the os internum.

The cervix consists mainly of connective tissue. A well-marked band of circular fibers exists in the cervix at the vaginal junction.

*The Peritoneal Coat.*—The uterus is partially enveloped in a transverse fold of the pelvic peritoneum. The latter structure invests the upper portion of the uterus, extending over the entire length of the organ posteriorly and to the isthmus anteriorly.

**The Nulliparous and the Parous Uterus.**—In the nulliparous uterus the corporeal cavity is triangular, the fundus nearly flat, the cervix somewhat conical, and the os externum a mere dimple. In the parous uterus the cavity



is oval, the fundus dome-shaped, the cervix cylindrical, and the os externum a transverse slit, with the lips more or less fissured. The differences in weight and in size have already been stated.

**Position of the Uterus.**—In the upright posture of the woman the average normal position of the uterus is such that the body lies nearly in a horizontal plane.

**Ligaments of the Uterus.** (a) *The broad ligaments.*—The pelvic peritoneum dips down posteriorly into the lesser pelvis, is reflected over one inch or more of the upper part of the posterior vaginal wall, covers the posterior surface of the uterus, and passing over the fundus invests the anterior uterine surface to the isthmus; thence it is again reflected upward and over the bladder. The uterus thus lies between the layers of a transverse fold of peritoneum, the lateral portions of which, stretching from the uterus to the sides of the pelvis in front of the sacro-iliac joints, form the broad ligaments. The two layers of each broad ligament are nearly in apposition, except at their junction with the pelvic floor and with the pelvic walls. The Fallopian tube is enveloped in a subsidiary fold of peritoneum at the upper margin of the broad ligament. The round ligament directly underlies the anterior layer. The ovarian ligament runs between the two layers. There are also included between the two layers important blood vessels, lymphatics, nerves, smooth muscular fibers and connective tissue.

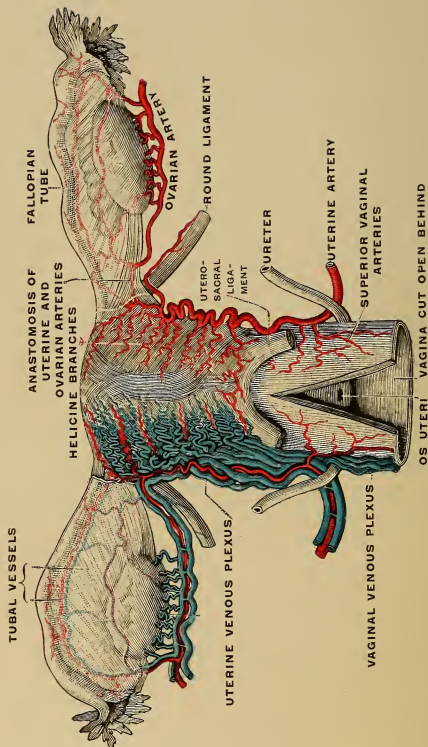
The *infundibulo-pelvic*, or *ovario-pelvic*, ligament is that part of the superior border of the broad ligament on each side, extending from the Fallopian tube to the pelvic wall.

(b) The *utero-sacral folds* are two semilunar folds of peritoneum enclosing unstriped muscular fibers and connec-





PLATE I.



Bloodvessels of the Uterus and its Appendages. (Testut.)

tive tissue, and passing one on each side of the rectum from the lower portion of the sides of the uterus to the second bone of the sacrum. In the nulliparous woman they spring from the uterus at the level of the os internum; in the parous, from points somewhat above the os internum. These folds are also known as the *folds of Douglas*, and the space between them as *Douglas's pouch* or *cul-de-sac*. Luschka terms these ligaments the retractors of the uterus.

(c) The *utero-vesical folds* are two folds of peritoneum, one on either side of the median line, which extend from the uterus to the bladder, forming the lateral borders of the utero-vesical space. They contain a few muscular fibers.

(d) The *round ligaments* are two slender, flattened musculo-fibrous cords which spring from the angles of the uterus in front of the Fallopian tubes, and pass forward through the inguinal canals to blend with the structures at and immediately below the external ring. They contain unstriated muscular fibers. Their length is 10 to 12.5 cm., 4 to 5 inches. A small artery and a vein pass through each.

**The Arteries.**—The arteries of the uterus are the two uterine, the two ovarian and the two funicular arteries, or arteries of the round ligaments. The uterine artery is a branch of the internal iliac, the ovarian springs from the aorta. They pass to the uterus between the folds of the broad ligament on either side. The uterine artery reaches the uterus just above the vaginal junction, the ovarian at the level of the cornua. The former runs up along the lateral border of the uterus to communicate with the ovarian.

The uterine arteries are remarkable for their free anastomoses and their tortuous course. Arterial tufts are given off at the lateral borders of the organ, whose branches form spirals within the uterine walls. They end in a mesh-

work of capillaries about the utricular glands. Other branches of the uterine arteries anastomose with those from the opposite side encircling the uterus. The circular artery surrounds the cervix at the isthmus, uniting the uterine arteries of the opposite sides with each other.

The artery of the round ligament, which is a very small one, is a branch of the vesical given off at the internal abdominal ring. It communicates at the cornua with the ovarian and the uterine artery.

**The Veins.**—The uterine plexus of veins lies immediately beneath the peritoneal coat of the uterus and extends between the folds of the broad ligament. It communicates with large sinuses in the middle muscular coat which are encircled by muscular bundles. The uterine veins also anastomose with the vaginal and the vesical plexuses. Their outlet is the hypogastric vein and the pampiniform plexus.

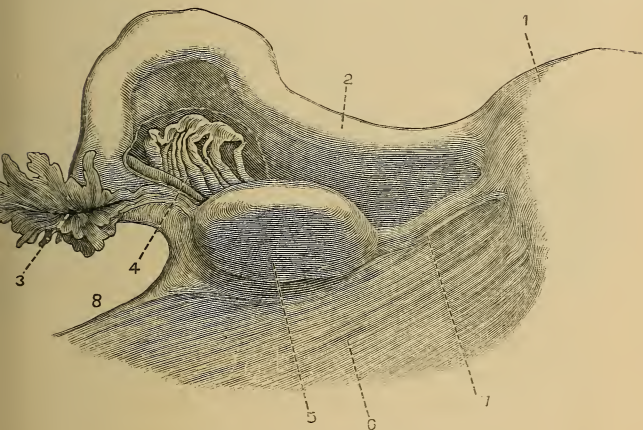
**The Lymphatics.**—These are very numerous in the body of the uterus, and they communicate with the lymph-spaces of the mucous membrane and the muscular coat. They form an intricate network immediately beneath the peritoneal coat of the uterus, and communicate with those of the Fallopian tubes. The uterine lymphatics are fully developed only during pregnancy. The lymphatics of the body of the uterus with those of the Fallopian tubes and the ovaries empty into the lumbar glands. A group which follows the course of the round ligament ends in the inguinal glands. The cervical lymphatics unite with those from the upper part of the vagina and empty into the internal iliac glands.

**The Nerves.**—These are derived chiefly from the sympathetic system, from the inferior hypogastric and spermatic

plexuses. The uterus also receives filaments from the second, third and fourth sacral nerves. The uterine nerves terminate in part in the nuclei of the muscle-cells.

**The Fallopian Tubes or Oviducts.**—These are two narrow tubes, one running outward from each horn of the uterus and communicating with the uterine cavity. The

FIG. 6.



Fallopian tube and ovary. (SAVAGE.)

outer portion of each tube takes a tortuous course, partially surrounding the ovary. The length of the tube is from 7.5 to 12.5 cm., 3 to 5 inches, the right a little longer than the left.

**Divisions.**—(a) The *isthmus* is the portion of the tube next the uterus. As it runs outward it expands gradually from 2 mm.,  $\frac{1}{12}$  inch, to 4 mm.,  $\frac{3}{16}$  inch, in diameter.

(b) The *ampulla* is the dilated portion of the tube next beyond the isthmus, about 1 cm.,  $\frac{1}{3}$  inch, in diameter. The fimbriated extremity, pavilion or infundibulum, is the free trumpet-shaped end of the tube, the margin of which is fringed with four or five processes called *fimbriae*. Here the tube expands abruptly to about 2 cm.,  $3\frac{1}{4}$  inches, in diameter.

The *fimbria ovarica* is a special fimbria, a little larger than the others, which is attached to the ovary.

The *ostium uterinum* barely admits a bristle, 1 mm.,  $\frac{1}{25}$  inch, in diameter.

The *ostium abdominale*, at which the body of the tube opens into the pavilion, is of the size of a small goose-quill, 5 mm. in diameter.

**Structure.**—Each tube comprises three layers continuous, respectively, with the corresponding layers of the uterus:

1. The *outer or peritoneal coat*, continuous with the peritoneal fold of the broad ligament. That part of the broad ligament between the tube and the ovary is termed the *mesosalpinx*.

2. The *middle or muscular coat*, composed of an inner circular and two outer longitudinal layers of unstriated muscular fiber. The outermost layer, however, is limited to the uterine end of the tube. The muscular coat contains a rich plexus of blood vessels.

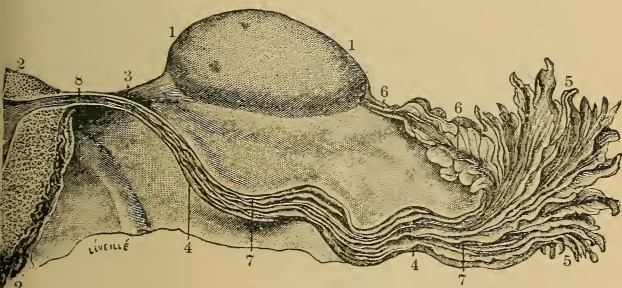
3. The *inner or mucous coat*. Except in the intramural portion of the tube, the mucous membrane is disposed in longitudinal folds, which become extremely complex in the ampulla. There is no distinct submucous layer. It is lined with ciliated columnar epithelium and is very vascular. The motion of the cilia propels toward the uterus.

According to Bland Sutton, the mucous membrane of the tubes is provided with glands. This is denied by Recklinghausen.

The arteries of the Fallopian tubes are branches of the ovarian and the uterine arteries.

The veins open into the pampiniform or ovarian plexus lying between the folds of the broad ligament below the tube.

FIG. 7.



The ovary and oviduct. (The latter opened longitudinally.) 1, 1. Ovary. 2. Part of the uterus. 3. Ovarian ligament. 4, 4. Oviduct, its walls opened by a longitudinal incision to show the longitudinal folds of its lining membrane. 5, 5. Pavilion from internal surface. 6, 6. Fimbria attached to the ovary, or tubo-ovarian ligament. 7, 7. Longitudinal folds. 8. Internal end of the oviduct.

The lymphatics unite with those from the body of the uterus, and from the ovary, and terminate in the lumbar glands.

The nerves are derived from the uterine and ovarian plexuses.

**The Ovaries.**—The ovaries, two in number correspond to the testes of the male.

**Situations.**—These organs are situated one on each side of the uterus 2.5 cm., 1 inch, or more below the level



of the ilio-pectineal line, and the same distance from the uterus; yet they have great mobility within normal limits. Each is set in the posterior fold of the broad ligament, and is connected with the corresponding horn of the uterus by the ovarian ligament.

**Shape.**—The usual shape of the ovary is a flattened ovoid; its free border is convex; the anterior edge is nearly straight. This straight border is the hilum. The ovary is thinnest at the hilum, thickest at the convex border. The inner end is narrower, pointed, and merges into the ovarian ligament; the outer is more obtuse and bulbous. The shape, however, is variable.

**Size.**—The size is about 3.5 cm.,  $1\frac{3}{8}$  inch, in length by 2 cm.,  $\frac{3}{4}$  inch, in width and 1.2 cm.,  $\frac{1}{2}$  inch, in thickness, but is variable. The average normal weight in the nullipara is about 6 grammes (85 grains). The size increases during menstruation.

**Structure.** 1. *External.*—In early age the external surface is smooth, like an almond. Later in life, after puberty, it gradually becomes uneven, acquiring a wrinkled appearance, owing to cicatrices from rupture of Graafian follicles. In the young adult subject it has a velvety softness and a pinkish or grayish-pearly color. In old age it acquires a cartilaginous hardness and a paler color. The free surface of the ovary is covered with modified peritoneum. Its epithelium is columnar and non-ciliated—the germinal epithelium of Waldeyer.

2. *Internal.*—The stroma is made up of connective tissue with some unstriped muscular and elastic fibers.

The tunica albuginea is a dense layer of stroma immediately underlying the germinal epithelium of the ovarian surface.

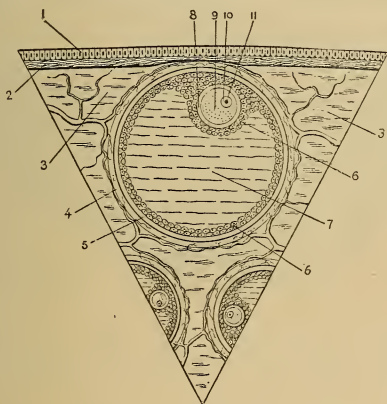


The zona parenchymatosa is the cortical portion of the ovary ; it has a grayish color.

The medullary zone, or zona vasculosa, is the portion about the hilum ; it is of a reddish color. Here enter the blood vessels, nerves, and lymphatics.

The **Ovarian Ligament** is a muscular band about 0.5 mm.,  $\frac{1}{5}$  inch, in width, which extends between the folds

FIG. 8.



Section of ovary magnified to show Graafian follicle and ovum. 1. Surface epithelium. 2. Tunica albuginea. 3, 3. Different parts of stroma. 4. Tunica fibrosa of follicle. 5. Tunicae propria. 6, 6. Tunica granulosa. 7. Liquor folliculi. 8. Vitelline membrane of ovum. 9. Vitellus. 10. Germinal vesicle. 11. Germinal spot.

of the broad ligament from the inner end of the ovary to the horn of the uterus, joining it immediately behind and below the origin of the Fallopian tube. Its length is about 2.5 cm., 1 inch. It is made up of connective tissue and smooth muscular fibers, the latter being continuous with the outer muscular layers of the uterus.

**The arterial supply** of the ovary is from branches of the ovarian artery which enter at the hilum. (Fig. 6.)

**The veins** issue from the hilum and empty into the pampiniform plexus. (Fig. 6.)

**The lymphatics**, with those of the tube and body of the uterus, empty into the lumbar glands.

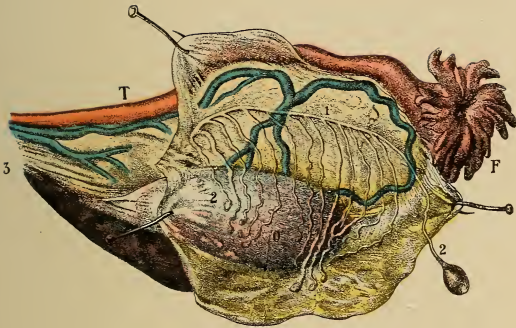
**The nerves** are derived from the inferior hypogastric plexus and the sacral nerves.

**Graafian Follicles.**—The Graafian follicles are the sacs in which the ova are developed. The follicles are developed from the germ epithelium of the ovarian surface, and become imbedded in the stroma by the outgrowth of connective tissue. They are most numerous in the cortical layer. Each follicle contains generally but one ovum. The number of rudimentary Graafian follicles at birth is 35,000 or more in each ovary. At any time during the child-bearing period ten or twenty Graafian follicles may be found in different stages of development upon the ovarian surface. The size of a mature Graafian follicle is  $\frac{1}{100}$  to  $\frac{1}{16}$  inch in diameter.

**Structure of a Graafian Follicle.**—The constituent parts of a Graafian follicle are : (1) The theca folliculi ; (2) the tunica (membrana) granulosa, a multiple layer of polyhedral epithelium ; (3) the discus proligerus, or germinal eminence, a heaped-up mass of cells of the membrana granulosa at one side, containing the ovum ; (4) the liquor folliculi, a clear, albuminous fluid—paralbumin.

**The Parovarium.**—The parovarium consists of a series of 10 to 20 tubules running between folds of the broad ligament in a slightly downward direction from the ovary toward the ampulla of the Fallopian tube. It is the remnant of the Wolffian body.

## PLATE II.



Meso-salpinx laid open, showing the Parovarium or Organ of Rösenmüller. (Savage.)

T, Fallopian Tube; F, fimbriated extremity of same; O, ovary; 1, remnant of Wolffian duct; 2, 2, remnants of the cæcal tubes of the Wolffian bodies; 3, ovarian ligament.



## CHAPTER II.

### PHYSIOLOGY OF PREGNANCY.

#### PHYSIOLOGY OF THE OVUM.

##### OVULATION.

**Ovulation** is the process by which the ovum or egg is matured and discharged from the ovary. At what intervals ovulation occurs in the human subject, and in what relation to the menstrual epoch, are not yet fully determined. Generally it takes place at about the time of the catamenia. Ovulation, however, may occur independently of menstruation, and menstruation without ovulation. Robinson believes that ovulation begins before birth and continues after the menopause. As a rule but a single follicle ruptures at each epoch.

##### MENSTRUATION.

Menstruation is a periodic congestion of the female genital organs, attended with a bloody uterine discharge—the *menses* or *catamenia*. The endometrium undergoes partial exfoliation and subsequent renewal. Popular terms for menstruation are the *monthly sickness*, the *courses*, *monthly turns*.

The constituents of the menstrual flow are blood and remains of the endometrium, together with uterine and vaginal secretions. The amount is from three to fourteen ounces; the length of the catamenial period is from two

to seven days ; the average duration four days ; the interval between the menstrual epochs is generally twenty-eight days. Intervals of several days more or less than the usual length, however, are to be considered normal, if constant. The source of the bloody discharge is the body of the uterus and probably the Fallopian tubes. Menstruation is usually attended with some degree of malaise, sacral pain and pelvic tenesmus.

**Puberty** is the period of sexual maturity, and is marked in the female by the onset of menstruation.

The age of puberty is usually about the fifteenth or sixteenth year. It varies with race, climate and other influences, occurring in exceptional instances as early as the tenth or as late as the twentieth year of age. It is earlier in warm than in cold climates, in the better than in the poorer classes, and in city than in country life. At this period the girl takes on the physical and mental characteristics of womanhood.

**The Menopause.**—The menopause is the final cessation of menstruation and the capacity for child-bearing. *Climacteric* and *change of life* are synonymous terms for menopause. In most women this period begins at the age of forty-six years. The change, however, is a gradual one, occupying three to five years. Variations of ten years or more on either side of this limit are possible. The anatomical changes which take place in the sexual organs are essentially the reverse of those which characterize the pubescent period. In extreme old age the uterus is reduced to its infantile dimensions and the tubes and ovaries are almost obliterated. As a rule the menstrual function continues latest in those in whom it begins earliest. In cold climates the fruitful period begins

late and ends late, and in hot climates it begins early and ends early. At the onset of the menopause the catamenia recur at irregular intervals, and finally they cease altogether. The intervals may be shortened or prolonged. The flow may be scanty or profuse and prolonged. Headache, tinnitus aurium, vertigo, hot flashes, palpitation, dyspnoea, faintness, pruritus and neuralgias are common nervous disturbances at this period.

**Phenomena Attending the Rupture of a Graafian Follicle.**—Loops of blood vessels are projected into the cavity of the follicle, and an increase of the fluid contents of the sac takes place from the increased vascularity. Adjacent portions of the ovary, and to a certain extent its entire structure, exhibit a similar increase in vascularity. The follicle is now apparent as a bright red spot on the surface of the ovary.

The overlying ovarian structure undergoes absorption owing to increased pressure of the liquor folliculi. The distending follicle finally ruptures and discharges its contents, an effusion of blood taking place into the follicle after rupture.

The ovum is apparently floated into the pavilion of the tube by a stream of serum which is propelled by the cilia of the fimbria ovarica. Its propulsion through the Fallopian tube is accomplished partly by ciliary motion, and, in the narrower portion of the tube, partly, perhaps, by muscular action. Heil thinks other agencies are concerned in the migration of the ovum into the oviduct, and believes, as was formerly assumed, that the pavilion of the tube grasps the ovisac.<sup>1</sup> Rarely it happens that the ovum migrates across the pelvic cavity and into the opposite Fallopian tube.

<sup>1</sup> Arch. f. Gyn., 1894, B. XLIII., H. 3.

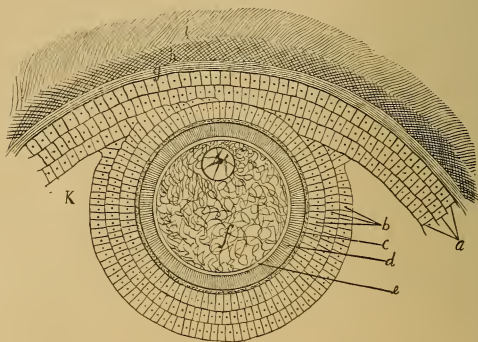
**The Ovum.**—The ovum is primarily a nucleated cell developed from the germ epithelium which covers the surface of the ovary. Its diameter at maturity is  $\frac{1}{120}$  inch.

The constituent parts of the ovum are :

The *vitelline membrane* ;

The *vitellus* or *yolk*, oleo-albuminous matter, containing shining granules ;

FIG. 9.



Section of nearly mature ovum and part of Graafian follicle. *a*, Membrana granulosa. *b*, Discus proligerus. *c*, Vitelline membrane. *f*, Vitellus.

The *germinal vesicle*, which is the nucleus of the cell,  $\frac{1}{100}$  inch in diameter, situated to one side of the yolk near its surface ;

The *germinal spot*, the cell nucleolus, a dark, granular spot, about  $\frac{1}{3000}$  inch in diameter, within the vesicle.

**The Female Pronucleus.**—The germinal vesicle approaches one pole of the ovum, and two rounded masses, the polar globules, are successively extruded from the sur-

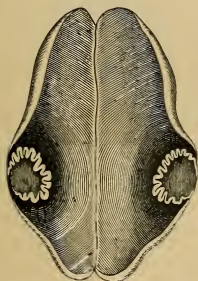


face of the egg. The office of these bodies is unknown. The remaining portion of the germinal vesicle reappears in the center of the egg, and is now known as the female pronucleus. As will be seen presently, the fusion of the female with the male pronucleus is the essential fact in fecundation.

**The Corpus Luteum.**—The corpus luteum is the body formed in the ovary by the changes which take place in the Graafian follicle after rupture.

*The corpus luteum of menstruation* reaches its full devel-

FIG. 10.



Section of human ovary, showing corpus luteum.

opment in from two to four weeks, and it becomes reduced to a mere cicatrix in about two months.

*The corpus luteum of pregnancy* grows for six or seven weeks, then it remains stationary to the end of the fourth month; from that time it retrogrades slowly till term, and becomes a mere cicatrix by the end of a month after childbirth. The period of growth, however, and the rapidity of decline, are not in all cases the same.

## CONCEPTION—IMPREGNATION.

Impregnation, or conception, is the fructification of the ovum by union with the spermatozoön, the fecundating element of the male. *Insemination* is the act by which the seminal fluid is deposited in the female genital tract.

**The Seminal Fluid.**—The seminal fluid is a glutinous, alkaline, albuminous fluid, of a whitish color, heavier than water, and is the combined product of the testicles, the prostate and Cowper's glands. The quantity ejaculated during an orgasm is from one to three drachms. Its chemical constituents are water, fats, proteids, calcium and sodium chlorides and phosphates. The proportion of mineral ingredients is about 3 per cent. Its microscopic elements are epithelium, leucocytes, spermatozoa, and crystals of calcium phosphate.

**The Spermatozoa.**—The spermatozoa are bodies of microscopic size resembling tadpoles in shape. The parts of the spermatozoön are a flattened ovoid head (cell nucleus) and a long thread-like tail. The filiform tail maintains a constant vibratile motion, the result of amœboid movements of protoplasm, so long as the spermatozoön retains its fecundating power. The total length of a spermatozoön is  $\frac{1}{600}$  to  $\frac{1}{400}$  inch.

**Vitality of Spermatozoa.**—Under favorable conditions the spermatozoa, as well as the ovum, live within the genital passages of the female for a week or more. In the human species they have been found in active motion after eight days. Dührssen found them alive in the Fallopian tube after three and a half weeks.

They are destroyed by extremes of heat or cold. The seminal elements of man retain their motility, however,

between the temperatures of  $5^{\circ}$  and  $116^{\circ}$  F. They are destructible by acids, by numerous other chemical agents and by desiccation.

**The Migration of Spermatozoa.**—Under normal conditions the male fluid is ejaculated upon and about the cervix. Yet the spermatozoa may traverse the entire length of the female genital tract by their own powers of locomotion, and impregnation may take place in exceptional cases without introception of the male organ. Locomotion is accomplished by the lashing action of the tail. The rate of motion is about an inch in seven and one-half minutes.

**Place, Time and Mode of Impregnation.**—Impregnation is by most authorities thought to take place in the outer portion of the Fallopian tube. The usual date of conception is probably within a week after the cessation of a menstrual period. As a rule, the ovum is fecundated by a single spermatozoön. The spermatozoön penetrates the egg, its tail is absorbed, and its head forms the male *pronucleus*. The male moves toward the female pronucleus and unites with it to form the *vitelline* or *segmentation nucleus* of the fecundated egg. The fructified egg is called the *öösperm*.

#### DEVELOPMENT OF THE IMPREGNATED OVUM.

The egg on leaving the ovary has a diameter of  $\frac{1}{120}$  inch. At its escape from the ovary it is partially enveloped in cells of the *membrana granulosa*. During its transit through the oviduct it receives an albuminous envelope which supplies the first nutriment for its development. On its entrance into the uterus it lodges in the folds of the decidua.

**Segmentation.**—Immediately after the formation of the vitelline nucleus the yolk subdivides into two spheres. The process of cleavage begins in the nucleus and extends throughout the vitelline mass. The two cells thus formed lie within the zona pellucida. By the continuance of the process of segmentation these cells divide into four and the four into eight, and so on until the entire yolk becomes a granulated mass. The latter has received the name of the *muriform body*. Cleavage taking place through the vitelline nucleus, its ultimate segments form the nuclei of the resulting cells. These cells are of two sizes. The smaller, which are the more transparent and are cubical in shape, are the epiblastic; the larger which are polygonal in form, are the hypoblastic cells. Segmentation in the human subject probably does not occupy more than six days. By the time it is complete the ovum usually has reached the cavity of the uterus and has grown to a diameter of  $\frac{1}{50}$  to  $\frac{1}{25}$  inch.

**The Blastoderm.**—The epiblastic cells unite to form a continuous layer which lines the zona pellucida. This is the *epiblast* or *ectoderm*.

By the union of the hypoblastic cells is formed another layer, the *hypoblast* or *endoderm*. The epiblast and the hypoblast are in contact within the area which marks the site of the future embryo, elsewhere they are separated by fluid. Between these two a third layer, the *mesoblast* or *mesoderm*, is subsequently formed. This layer, however, is limited to that part of the oöperm at which the embryo is to be developed. The three layers together constitute the *blastoderm*. The oöperm, now dilated into a vesicle by accumulation of fluid in its cavity, is called the *blastodermic vesicle*.

## DEVELOPMENT OF THE EMBRYO.

From the ectoderm are formed the epidermis, hair, nails, teeth and the glandular structures of the skin, the mammary glands, cerebro-spinal nervous system, the organs of special sense, and the chorion, amnion and placenta.

From the mesoderm are developed bone, muscle, connective tissue, the heart and blood vessels, peritoneum, pleuræ, pericardium, spleen and the genito-urinary organs.

From the endoderm are formed the lungs, liver, stomach, œsophagus, pancreas, intestines, the epithelium of the digestive tract, the bladder, and the allantois.

The *area germinativa*, or *embryonic spot*, appears upon the blastoderm as an opaque, oval spot, consisting of an aggregation of hypoblastic cells on the inner surface of the membrane. In the long axis of this area the embryo is developed.

The *area pellucida* is a clear, oval space, which soon appears in the center of the area germinativa.

The *primitive trace* is a longitudinal streak which appears in the median section of the area pellucida in consequence of a thickening of the blastodermic layers in this part.

The *medullary canal*. Two longitudinal folds spring up, one on either side of the primitive trace, and by the end of the first month of intrauterine life they have arched over and united to form the medullary or cerebro-spinal canal.

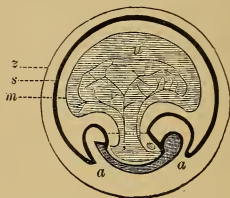
*Somatopleure and Splanchnopleure*.—The mesoblast on either side of the median-axial line splits into two laminæ, the outer one of which unites with the epiblast to form the somatopleure or primitive body-wall, and the inner

one with the hypoblast to form the primitive splanchnopleure or rudimentary digestive tract. The space between the somatopleure and the splanchnopleure is the primitive body-cavity. This is ultimately divided into pleural, pericardial and peritoneal cavities.

### THE FŒTAL MEMBRANES.

**The Amnion.**—This is the innermost of the fœtal envelopes. At about the time when the embryo begins to take shape folds of the somatopleure spring up around the edges of the embryo. (Figs. 11 and 12.) This mem-

FIG. 11.



*a, a.* Beginning development of amnion. *z.* Zona pellucida or vitelline membrane.  
*s.* Epiblast. *m.* Hypoblast. *u.* Umbilical vesicle.

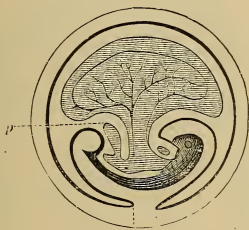
branous ridge grows until its edges meet over the back of the embryo. The surfaces brought into contact become fused together. (Fig. 13.) The pouch thus formed is the amnion. Within it is the embryo. It is gradually expanded by accumulation of its fluid contents, the liquor amnii.

The outer layer of the folds, which is termed the false amnion, recedes to the vitelline membrane.

The liquor amnii is an alkaline liquid having a specific gravity of 1002 to 1015. In the earlier months of preg-

nancy it is clear and transparent; in the later months it becomes turbid, owing to the presence of skin epithelium, lanugo and particles of vernix caseosa. At the time of labor it sometimes has a dark greenish-brown color, from the presence of meconium. In the first half of pregnancy it is contributed from a system of capillary blood vessels of the placenta immediately underlying the amnion. In the later months, according to some authorities, it consists

FIG. 12.



*a, a.* Development of amnion at a more advanced stage. *p.* Allantois.

partly of foetal urine. Others deny that foetal urine is discharged into the liquor amnii except during labor.

Its principal constituents in the last weeks of pregnancy are water, a trace of albumin, mucin, saline matter, creatin, creatinin, urea, epithelium. The normal quantity at term is from one to two pints.

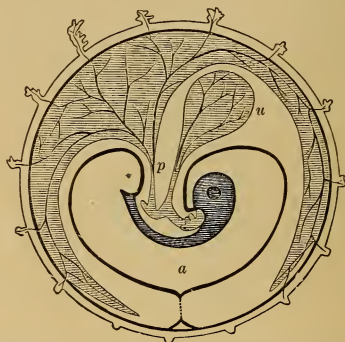
**Uses.**—During gestation it not only permits active foetal movements, but it protects both the uterus and the foetus by equal distribution of the intrauterine pressure. Swallowed by the foetus, and, in the early months of gestation, absorbed through the skin of the embryo, it supplies water to the foetal tissues. During parturition, so



long as the membranes are unbroken, it helps to dilate the cervix by hydrostatic pressure.

**The Allantois.**—The allantois is a diverticulum developed from the posterior part of the endoderm or the intestinal canal at about the time the amniotic folds are formed. It is projected to the outer envelope of the ovum, which now consists of the vitelline membrane and the false

FIG. 13.



Amnion complete. Allantois in contact with external envelope of ovum.

amnion joined in one. It spreads until, by the end of the third week, it lines the entire external envelope of the ovum as a flattened sac. (Figs. 12, 13 and 14.)

Its office is to carry blood vessels from the embryo to that portion of the outer envelope at which the placenta is to be developed. The allantoic arteries are two in number; after the complete development of the umbilical cord they are called the umbilical arteries.

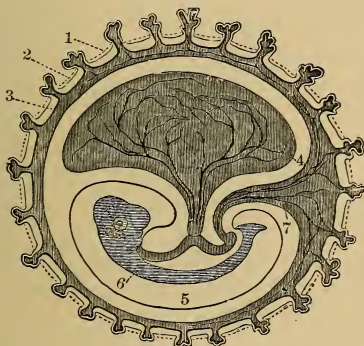
The stem of the allantois ultimately dwindles to a mere cord, which is termed the *umbilical communication*: this is the rudimentary umbilical cord.



**The Chorion.**—This structure consists mainly of a layer of connective tissue and one of pavement epithelium. The former becomes fibrous in the later months of pregnancy.

In the second week of its development the ovum becomes invested with villousities which spring from its outer covering, the vitelline membrane. This envelope, with its villi, is the *primitive chorion*. The *permanent chorion*

FIG. 14.



Allantoic folds united. 4. Umbilical vesicle. 7. Stem of allantois.

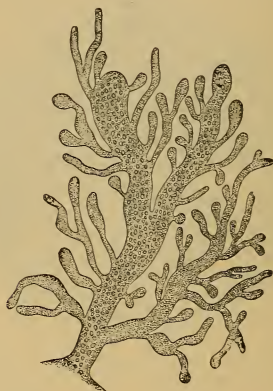
is formed by fusion of the allantois with the vitelline membrane and the false amnion. This structure consists mainly of a layer of connective tissue and one of pavement epithelium. The former becomes fibrous in the later months of pregnancy. The space which persists for the time between the amnion and the chorion is filled with a gelatinous material.

**Union of the Fœtal Envelopes.**—The amniotic sac expands until it reaches the chorion and blends with it about the end of the second month. At that time the coverings

of the ovum, from within outward, are the amnion, the chorion, the decidua reflexa, the decidua vera. Soon after the third month they become practically a single membrane. The ovum loosens its hold upon the uterus at term by the formation of a meshy layer in the decidua.

**Chorial Villi.**—Shortly after the fixation of the ovum the surface of the chorion, as has already been stated, be-

FIG. 15.



Compound villus from ovum of three months. (Magnified 30 diameters.)

comes covered throughout with transparent villi. The villi penetrate the decidua, and from it they derive nutrient material for the sustenance of the growing ovum. At first they are single, but as the ovum develops they elongate and become compound. (Fig. 15.) The external surface of the globular ovum is, at this period, everywhere "shaggy." (Fig. 14.)

**Blood Vessels of the Villi.**—At first the villi are not vas-

cular, but they soon receive blood vessels from the allantois. The capillaries of the chorial villus enter the stem of the villus, follow its subdivisions to the end of each rootlet, there forming loops, and return to empty into the venous trunks of the chorion. The chorial villi are comparable, in structure and function, to those of the intestines.

**Chorion Læve.**—Toward the end of the second month the chorion begins to grow bald over its entire surface, except the portion corresponding to the insertion of the foetal blood vessels. Thus by the end of the second month two-thirds of the surface of the chorion is smooth, the *chorion læve*.

**Chorion Frondosum.**—Over the remaining third of the chorial surface the villosities grow more profusely than before to form a thick, spongy mass of villosities; this part of the chorion is the *chorion frondosum*. The villi are destined to form the foetal portion of the placenta. In the placental part of the chorion the development of the vessels keeps pace with that of the villosities; elsewhere the capillaries shrink with the atrophy of their villi.

After full development of the placenta the non-placental portion of the chorion, the *chorion læve*, serves only for protection.

**The Decidua.**—With the fixation of the impregnated ovum upon the uterine mucous membrane, the latter structure undergoes important alterations. It becomes increased in vascularity and in thickness, and a fold of the mucosa grows up around the ovum, completely enveloping it. This hypertrophied mucous membrane of the uterus is called the decidua. That part of the decidua which underlies the portion of the ovum at which the

placenta is subsequently to be developed is the *decidua serotina* or *placental decidua*. The rest of the uterine mucous lining is the *decidua vera* or *uterine decidua*. (Fig. 16.) The reflected portion which envelopes the ovum is termed the *decidua reflexa* or *circumflexa*, the *ovular* or *epichorial decidua*. (Figs. 17 and 18.) The space intervening between the reflexa and the vera is filled with thick, viscid mucus. The reflexa grows with the ovum and comes in contact with the vera during the fourth month, uniting

FIG. 16.



Decidua with ovum  
lodged in its folds.

FIG. 17.



Beginning formation  
of reflexa.

FIG. 18.



Reflexa completely envelop-  
ing the ovum.

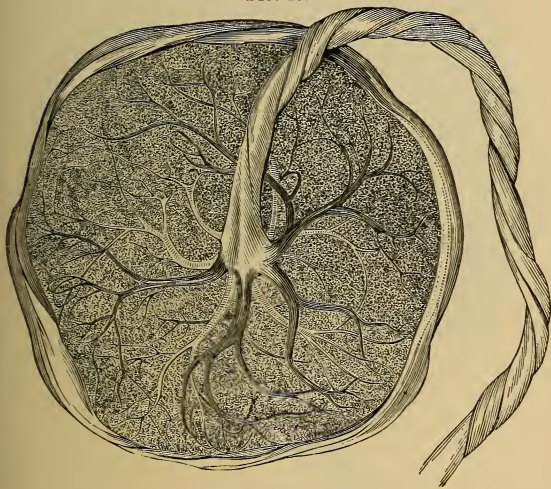
with it. The cavity of the uterus is from this time completely filled by the ovum and its coverings. Except at the placental site, the deciduæ undergo atrophy and are reduced to a single thin membrane by the close of the first trimester; the decidua reflexa disappears entirely after the seventh month.

**The Placenta.**—The placenta, or after-birth, when fully developed is a mass of spongy consistence and lenticular shape, measuring from 18 to 20 cm., 7 to 8

inches, in diameter and about 2.5 cm., 1 inch, in thickness at the insertion of the cord. Its outline is sometimes round, most frequently oval. Its usual weight is 454 grms., 1 pound. The size of the placenta, however, usually varies with that of the child.

The *foetal surface* is a smooth, somewhat concave surface

FIG. 19.



Foetal surface of placenta.

of amniotic membrane. The insertion of the umbilical cord is most frequently central or nearly so; sometimes it is eccentric or even marginal. The larger ramifications of the placental vessels are visible beneath the foetal membranes. (Fig. 19.)

The *maternal surface* is brownish-red, slightly convex

and rough, presenting divisions into irregular lobes or cotyledons from 1 to 4 cm.,  $\frac{1}{2}$  to  $1\frac{1}{2}$  inches, in diameter, and sixteen to twenty in number. These lobes are separated by membranous septa which penetrate the substance

FIG. 20.



Maternal surface of placenta.

of the placenta to the foetal surface. The maternal surface is covered with the outer layer of the serotina.

The *placental seat* is normally the upper segment of the uterus. It is found on the anterior or the posterior wall with nearly equal frequency. It may be situated, how-





# PLATE III.



Semi-diagrammatic Section of Placenta and Uterine Wall in the Fifth Month.  
(After Leopold.)

V. Villi. L. Lacunae.



ever, on any portion of the walls of the body of the uterus.

**Development.**—The formation of the placenta begins in the second month of pregnancy. Its limits are distinctly defined by the end of the third; its characteristic form and structure are complete by the end of the fourth month. The chorionic villi are projected into the interglandular portions of the endometrium and ramify to form dendritic tufts. The walls of the crypts into which the villi dip are lined with epithelium and are extremely vascular. The capillaries around the crypts become enlarged and inosculated till every loop of the foetal villi is surrounded by a meshwork of dilated maternal capillaries. The latter enlarge, obliterate the interspaces, and coalesce into lakes of blood. These blood-spaces are in free communication with the uterine sinuses.

**Structure.**—The placenta is made up essentially of foetal and maternal blood vessels. The vascular foetal tufts, sixteen to twenty in number, are suspended, as it were, in lakes of maternal blood. The latter are fed by the curling arteries of the uterus. The maternal blood returns from the spaces between the foetal tufts by the coronary vein at the margin of the placenta and by sinuses in the septa between the cotyledons. The foetal and maternal circulations have no direct communication with each other. (Plate III.)

**Function.**—The placenta is at once the nutritive, the respiratory, and the excretory organ of the foetus. The interchange between the foetal and maternal circulation takes place by osmose through the walls of the foetal villi.

**The Umbilical Cord.**—The umbilical cord is the pedicle which, during gestation, connects the foetus with the

placenta. It is developed from the stalk of the allantois. Its foetal insertion is at the umbilicus, the placental is generally nearly central. (Plate IV.)

The usual length of the cord varies from 7 to 60 inches. Greater variations are exceptionally observed. The average length is 20 inches. Its diameter is about that of the little finger of the adult. The tensile strength, at term, is from five to twelve pounds.

**Structure.**—The cord contains the remnants of the vitelline duct and the umbilical vesicle and the umbilical vessels imbedded in a jelly-like connective tissue, the jelly of Wharton. It is invested with a sheath derived from the primitive somatopleure. The covering, though resembling amnion, is not a process of that structure, as usually assumed.

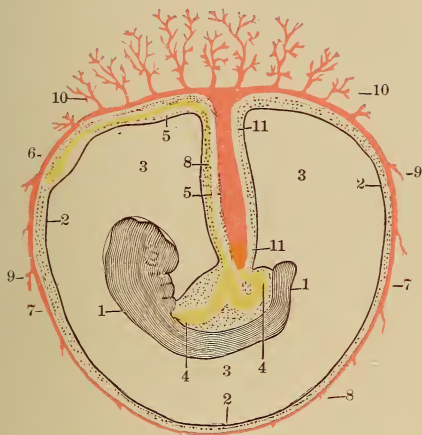
**Blood Vessels.**—Primarily it has two arteries and two veins; subsequently one of the veins disappears. Exceptionally there is but one artery. The walls of the arteries are but little thicker than those of the veins. The vessels of the cord are arranged in spirals, the vein appearing to be wound around the arteries. According to recent observations nutritive capillaries, and also nerves and lymphatics, are to be found in the cord.

### **Rate of Development of the Embryo and Fœtus.**

**First Month.**<sup>1</sup>—The ovum is of the size of a pigeon's egg; its diameter is 2 cm.,  $\frac{3}{4}$  inch. Chorionic villi are present over its entire surface. The length of the embryo is nearly 1 cm.,  $\frac{1}{3}$  inch; its weight about 1 gramme, 15.43 grains. The first rudiments of foetal structure are discernible. The heart, kidneys, liver, extremities, and the eyes,

<sup>1</sup> Lunar month.

# PLATE IV.



Evolution of the Placenta and of the Umbilical Cord.  
(From Sappey.)

- |   |  |
|---|--|
| 1, 1. Embryo.                           | 7, 7. Allantois Vessels.                           |
| 2, 2, 2. Amnion.                        | 8. Pedicle of the Allantois.                       |
| 3, 3, 3. Cavity of Amnion.              | 9, 9, 9. Chorial Villi beginning to atrophy.       |
| 4, 4. Digestive Canal.                  | 10, 10. Villi in relation with the utero-placental |
| 5, 5. Pedicle of the Umbilical Vesicle. | decidua, which hypertrophy.                        |
| 6. Umbilical Vesicle.                   |  |



the oral and anal orifices begin to be formed. The nose and mouth are one cavity. The heart begins to beat at the third week. The abdomen is not fully closed. The spinal canal closes. The members are indicated by papillæ.

**Second Month.**—The ovum is of the size of a hen's egg, 6.5 cm.,  $2\frac{1}{2}$  inches, in diameter; the length of the embryo is about  $2\frac{1}{2}$  cm., 1 inch. Rudimentary vertebræ appear. The frontal unite with the superior maxillary processes. Centers of ossification are present in the inferior maxillary bone, the clavicle and the sides and bodies of the vertebræ. The visceral arches are closed, or nearly so. The eyes, nose, and ears begin to take form. The mouth and nose are separate cavities. Rudiments of hands and feet appear, but the fingers and toes are webbed. The umbilical vesicle has disappeared. The umbilical cord is about 2.5 cm., 1 inch, in length. Sexual organs are apparent.

**Third Month.**—The ovum is of the size of a goose's egg; its diameter is 4 to 9 cm.,  $1\frac{1}{2}$  to  $3\frac{1}{2}$  inches; the average length of the embryo is about 6.5 cm.,  $2\frac{1}{2}$  inches; its weight 30 grammes. The placenta is nearly complete; the villi have atrophied over two-thirds of the chorion. The umbilical cord is 7 cm.,  $2\frac{3}{4}$  inches, in length, and its vessels begin to be twisted. The external parts of the embryo are distinctly formed. Ossific centers are apparent in most of the bones. The fingers are separated, also the toes. Rudimentary finger- and toe-nails are present. The cavities are wholly closed. Sex is determinable by the presence or absence of a uterus. Active foetal movements begin in the latter part of this month.

**Fourth Month.**—The average length of the foetus is 13 cm.,  $5\frac{1}{8}$  inches; its average weight is about 56

# PLATE V.



The Mature Ovum. (After Runge.)

*A.* Uterine Wall.  
*B.* Placenta.  
*C.* Umbilical Cord.  
*D.* Decidua.

*E.* Chorion.  
*F.* Amnion.  
*G.* Foetus.  
*H.* Amnial liquor.

$\frac{2}{3}$  inch less than at term ; the average weight is about 2,721 grammes, 6 pounds ; an ossific nucleus first appears in the lower femoral epiphysis. Lanugo is disappearing from the body.

**Tenth Month.** *Signs of Maturity.*—Measurements : length 45 to 50 cm., 18 to 20 inches ; suboccipito-bregmatic circumference 33 cm., 13 inches ; length of foot 8 cm.,  $3\frac{1}{8}$  inches. The weight is 3,175 to 3,288 grammes, 7 to  $7\frac{1}{4}$  pounds. The eyes are usually open. The face and body are plump. The child suckles and cries lustily. Lanugo is almost wholly absent from the body. Vernix caseosa, as a rule, is present only on the child's back and on the flexor surfaces of the limbs. The finger-nails overreach the finger-tips, the toe-nails extend to the end of the bed of the nail. The cartilages of the ear and of the nose have become firm. The cranial bones are hard, and the sutures and fontanelles small. Centers of ossification are well developed in the lower epiphyses of the femurs and in the astragalus ; they are beginning to appear in the upper epiphysis of the tibia and in the cuboid bone. (Plate V.)

### FCETAL CIRCULATION.

The peculiarity of the foetal circulation arises chiefly from the fact that pulmonary respiration is in abeyance during intrauterine life, the respiratory blood-changes being accomplished in the placenta. Only so much blood goes to the lungs as is needed for their nutrition. From the placenta the blood passes to the umbilical vein. A part goes directly to the ascending cava by the ductus venosus, and a part reaches it indirectly through the liver and the hepatic vein. Together with the blood from the



lower extremities it then goes to the right auricle, and thence is deflected through the foramen ovale into the left auricle by the Eustachian valve, whence it passes through

FIG. 21.

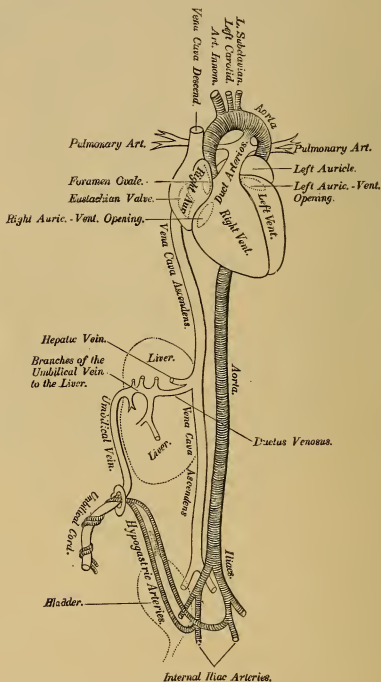


Diagram of the fetal circulation. (FLINT.)

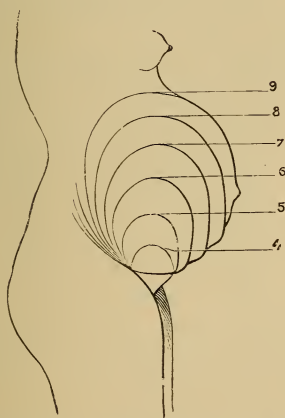
the left ventricle and into the aorta. The larger part goes to the arms and the head. Returning by the descending cava to the right auricle it goes to the right ven-

tricle, a very small part passing to the lungs by the pulmonary artery, the larger part reaching the aorta through the ductus arteriosus ; a small portion of this mixed blood goes to the lower extremities, the greater part being returned again to the placenta by the hypogastric arteries.

## EFFECTS OF PREGNANCY ON THE MATERNAL ORGANISM.

**Changes in the Uterus.**—Naturally the first effects of pregnancy are to be found in the uterus. The most nota-

FIG. 22.



Size of uterus at different periods of pregnancy.

ble clinically are the alterations in the size, shape and structure of the uterus.

**Size.**—The growth of the uterus begins immediately on fixation of the ovum, and is continuous with its growth.

In the first two months its development is chiefly in the lateral and antero-posterior directions. Subsequently the growth is nearly symmetrical. It is mainly due to hypertrophy and to hyperplasia of its muscular fibers. In the later months the enlargement is in part by dilatation.

The thickness of the uterine walls at term is between 4 and 6 mm.,  $\frac{1}{6}$  and  $\frac{1}{4}$  inch. The internal surface is expanded between conception and full term from 32 or 39 square cm., 5 or 6 inches, to 2256 square cm., 350 square inches. The cubic capacity of the uterus is enlarged more than five hundred times, to 4000 cc. or more. The weight increases from 43 grammes,  $1\frac{1}{2}$  ounces, its weight in the pregravid state, to 904 or 1133 grammes, 2 to  $2\frac{1}{2}$  pounds, at term.

*Dimensions of the Gravid Uterus.*

Stage of gestation.	Total length.	Width.
12 weeks	12.5 cm. (5 in.)	10 cm. (4 in.)
16 weeks	15 " (6 " )	12.5 " (5 " )
20 weeks	17.5 " (7 " )	15 " (6 " )
24 weeks	21.5 " ( $8\frac{1}{2}$ " )	16.5 " ( $6\frac{1}{2}$ " )
28 weeks	25 " (10 " )	17.5 " (7 " )
32 weeks	29 " ( $11\frac{1}{2}$ " )	20 " (8 " )
36 weeks	33 " (13 " )	22.5 " (9 " )
40 weeks	35.5 " (14 " )	25 " (10 " )

**Shape.**—In the first three months the shape of the uterus is irregularly pyriform ; in the second, the body of the uterus is a flattened spheroid, its antero-posterior diameter being the smallest ; in the last it is generally egg-shaped, the fundal being the larger end. Yet the form of the uterus in the later months is not altogether constant.

**Structure.**—The changes which take place in the mucosa have already been described. The muscular fibers grow 7 to 11 times in length, 2 to 5 times in thickness ;

there is also some hyperplasia of muscular tissue. At the internal os there is a preponderance of circular fibers in all the layers. The peritoneal coat develops in proportion to the increasing size of the uterus.

The arteries increase in number, length and caliber. By the later months of pregnancy the ovarian arteries attain the size of goose-quills, and the uterine arteries are somewhat larger still. The size of the lateral branches, which connect the ovarian and the uterine arteries on each side exceeds that of the radial artery. The uterine venous plexus develops into a system of huge sinuses in the middle coat of the muscularis, and in the subplacental portion of the inner coat. Some of these vessels attain a diameter of 12 mm.,  $\frac{1}{2}$  inch. The ovarian and uterine veins are proportionally enlarged. The lymph-tubes reach the size of goose-quills and the lymph-spaces are expanded. Hypertrophy of the nervous structures keeps pace with the general uterine development.

**Changes in the Cervix Uteri.** **Size.**—The apparent shortening of the cervix during pregnancy is due partly to softening of its structure and partly to swelling of the vaginal mucosa and the loose cellular tissue about the cervix at the vaginal junction. The cervical enlargement is partly hypertrophic, but is mainly due to loosening of its structure in consequence of serous infiltration; it is progressive to about the end of the eighth month.

**Structure.**—Softening extends progressively from the lower border upward; it involves the entire cervix by the end of the eighth month. By this time generally the cervical canal has become sufficiently expanded in multiparæ to admit the finger, and the head of the child may be felt through the membranes. In women pregnant for the first

time the os externum is seldom as large as the finger, even in the later weeks of gestation.

**Changes in other Pelvic Structures.**—The *uterine peritoneum* is developed by tissue-growth proportionately to the development of the uterus itself.

The *broad ligaments* adapt themselves to the expansion of the uterus partly by the separation of their layers and partly by growth in the number and size of their tissue-elements.

The *ovaries* and the *Fallopian tubes* lie in contact with the sides of the uterus by the time it rises out of the lesser pelvis.

The *vagina* undergoes hypertrophy during pregnancy. The width and length of its walls are increased and it becomes more vascular.

**General Changes.** *The Heart.*—According to most authorities there is a physiological hypertrophy of the left ventricle of the heart during gestation, which is designed to meet the increased resistance in the systemic circulation brought about by the superadded utero-placental circulation. The pulse-rate is slightly accelerated.

*The Blood.*—The total volume of blood is increased in the latter half of pregnancy. There are an increase in the proportion of white globules and a diminution in that of the red corpuscles and albumin. In the later months there is more fibrin. The proportion of water is normally little greater than in the non-gravid state. Extreme changes in the blood do not occur in normal pregnancy.

*The Nervous System.*—In most gravidæ there is a marked increase in the irritability of the nervous system. Psychic disturbances, neuralgias and other nervous disorders are frequently observed.

*The Body-weight.*—As a rule, a considerable gain in body-weight occurs in the later months, due mainly to increased adipose deposit.

*The Thyroid.*—The thyroid gland is hypertrophied during pregnancy, and to a certain degree the enlargement remains permanent.

Similar changes also occur in the liver, spleen and, probably, in the kidneys.

## SIGNS OF PREGNANCY.

### A. HISTORY.

*Suppression of Menses.*—In a woman of previously regular menstrual habit, and in the absence of other appreciable causes of amenorrhœa, the arrest of the catamenia is to be regarded as strong presumptive evidence of pregnancy. Other possible causes of suppression must, however, be excluded. These are :

Anæmia ;	Change of climate ;
Tuberculosis ;	Tardy menstruation ;
Chronic nephritis ;	The menopause ;
Exposure to cold ;	Emotional causes.

This sign is not in all cases available for diagnosis. Conception may take place during the physiological amenorrhœa of lactation or before the menstrual function is established. In a few recorded cases pregnancy has occurred after the menopause. On the other hand, periodical hemorrhages simulating menstruation are sometimes observed in the early months of pregnancy. The bleeding in such cases generally proceeds from polypi or other lesions of the cervix, from chronic decidual endometritis or from placenta prævia, and its occurrence at the

end of the menstrual month results from the influence of the menstrual molimen. Usually it may be distinguished from menstruation by the irregularity in the amount and duration of the flow. The typical menstrual discharge begins and ends gradually, and in the intervening time is nearly constant in quantity. The usual length of the menstrual period is four or five days. Bleeding from other causes seldom presents these characteristics.

**Nausea** is present for a time in the vast majority of pregnancies. Usually it begins about the end of the first month<sup>1</sup> and ceases by the end of the third, when the uterus rises out of the true pelvis. It may subside earlier or last longer; in exceptional instances no nausea is experienced during the entire period of pregnancy.

Generally it is a morning sickness. Sometimes it persists throughout the day. Pathological causes, such as chronic nephritis and chronic gastric catarrh, may simulate the morning sickness of pregnancy, and these must be excluded.

**Ptyalism** in greater or less degree frequently accompanies the nausea. Excessive salivation is exceptional.

Hypersecretion of mucus in the mouth and throat during the early months of gestation is more common. The tenacity of the secretion and the difficulty of expectoration have given rise to the term "spitting cotton."

**Certain mammary and abdominal signs** may be brought out in the history, such as enlargement, a sense of weight, fulness and tenderness of the breasts, growth and pigmentation of the abdomen and quickening.

<sup>1</sup> By the term month the calendar month is meant unless otherwise specified.



## B. PHYSICAL SIGNS.

### 1. Mammary Changes.

(a) **Increased Size and Fulness of the Glands.**—The milk-glands are enlarged by growth of the acini, swelling of the connective tissue and by interlobular deposit of fat. Development of the gland must be distinguished from overlying fat. The gland is readily identified on palpation by greater density and by its nodular border.

The fulness and firmness are not always well marked after mid-pregnancy. Rarely no material enlargement is observed during the entire period of gestation.<sup>1</sup>

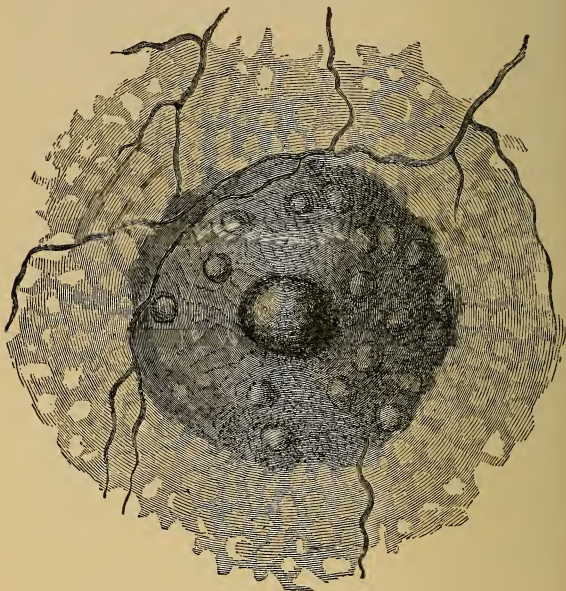
(b) **Primary Areolæ.**—Important changes take place in the areolæ. They become pigmented, elevated and œdematous. The depth of pigmentation varies according to the complexion of the patient. It is faintly developed in blondes, well marked in brunettes, and in the negress is nearly black. Sometimes it shades into the color of the surrounding skin at the upper and outer aspects of the areolæ toward the end of the second month. The areolæ acquire a soft, velvety feel and are slightly raised above the general level of the skin. The most significant of these changes in the primary areolæ is the pigmentation. (Fig. 23.)

(c) **Montgomery's follicles** are sebaceous follicles of the areolæ, ten to twenty in number in each, which have become hypertrophied during pregnancy. They appear as papular elevations within the primary areolæ. They are best displayed while the skin is held gently on the stretch. (Fig. 23.)

<sup>1</sup> Rinman calls attention to the fact that slender cords (hypertrophic acini) may be felt radiating from the nipple before the milk secretion begins.

(d) **Enlargement of Veins.**—The superficial veins of the breasts become fuller and more prominent. On slightly stretching the skin in a good light veins may be seen

FIG. 23.



The primary and secondary areolæ of pregnancy.

coursing across the areolæ. (Fig. 23.) Frequently a vein is seen encircling each primary areola at its margin.

(e) **Milk Secretion.**—Colostrum may be pressed from the nipples at the end of the third month. In women who have never borne children its presence affords presumptive evidence of pregnancy. Yet rarely milk secre-

tion is possible in virgins, sometimes even in males. The sign is of no value after the first pregnancy, since usually milk may be found in the breasts of parous women.

To elicit this sign the manipulation should begin over the ampullæ of the milk-ducts at the base of the nipple.

(*f*) **Secondary Areolæ.**—These are faintly pigmented zones skirting the primary areolæ. (Fig. 23.) They are characterized by one or more rows of feebly marked circular spots just without the primary areolæ. The markings are due to non-pigmented sebaceous follicles. In women never pregnant before, the secondary areolæ are diagnostic when well made out.

**Date of Appearance of Mammary Signs.**—All the mammary signs, with two exceptions, may be looked for by the close of the second month. Colostrum is present at the third, and the secondary areolæ appear at the fifth month.

**Diagnostic Value.**—In primigravidæ the mammary changes usually afford sufficient evidence for, at least, a presumptive diagnosis of pregnancy. In women who have borne children they are not to be relied on since most of them once developed remain more or less permanent.

The group of mammary signs is rarely complete and those present are seldom equally well developed.

Breast-changes similar to those of pregnancy may result from pelvic disease. Pathological conditions of the sexual organs which may cause reflex mammary changes must, therefore, be excluded.

## 2. Abdominal Signs.

1. **Inspection.** (*a*) **Flattening.**—In the second month of gestation the abdomen is slightly flattened; the uterus

during this period sinks somewhat lower in the pelvis and the hypogastrium is therefore a little less prominent.

(b) **Enlargement** of the abdomen is apparent after the third month, when the uterus begins to rise out of the lesser pelvis; thereafter it increases with the growth of the uterus till the middle of the ninth month. Within two weeks or more before term the uterus usually sinks deeper in the pelvis and the waist-line becomes perceptibly smaller.

(c) **Pigmentation**.—As a rule pigmentation of the abdomen is limited to a narrow band about 3 mm.,  $\frac{1}{8}$  inch, in width extending from the pubes to the umbilicus, sometimes to the ensiform. It is present by the end of the second month. Pigmentation of the abdomen, like that of the breasts, varies in depth and extent of surface with the complexion of the patient. In brunettes a dark circle appears around the umbilicus, and pigmented patches are observed over other parts of the abdomen. In blondes entire absence of pigmentary changes is not infrequent. Deposits of pigment similar to those of pregnancy are sometimes observed in other conditions of health and disease.

(d) **Umbilical Changes**.—The umbilicus is retracted in the first three months and becomes protruded in the last two or three.

(e) **Lineæ Albicantes, or Striæ Gravidarum**.—These are irregular whitish, pinkish or bluish lines developed over the lower half of the abdomen during the later months of pregnancy. Sometimes they may be observed on the hips and thighs. The breasts may present similar markings. Usually they are slightly depressed below the general surface of the skin. They are due chiefly to partial atrophy of the skin from tension; they appear at about the sixth month.

Once formed they remain in greater or less degree permanent. Distention of the abdomen from causes other than pregnancy may give rise to similar changes.

2. **Palpation.** (*a*) **Size of the Tumor.**—The fundus uteri lies nearly in the plane of the pelvic brim at the third month, reaches the level of the umbilicus by the sixth and the ensiform cartilage at the thirty-eighth week. More accurate for our purpose than the situation of the fundus are the width and length of the uterus. For the uterine measurements at different stages of gestation see table on page 70.

(*b*) **Character of Tumor.**—The gravid uterus is normally a smooth, symmetrical, pyriform or ovoid, fluid tumor. In the second month when relaxed the body of the uterus is so soft and flaccid as to be almost imperceptible by palpation. In the last trimester, and even earlier, foetal parts may be made out by abdominal palpation. They are readily felt in the second trimester by the usual bimanual palpation.

(*c*) **Intermittent contractions** of the uterus may be detected by the fourth month by abdominal palpation, at an earlier period by the bimanual examination. They recur at intervals of five or ten minutes; may be obtained immediately by applying the hand cold, or by the use of gentle friction over the tumor. They are not abolished by the death of the foetus. Hæmatometra, hydrometra, distended bladder and soft fibroids, in all of which contractions may occur, must be excluded.

The value of this sign, to which much importance was formerly attached, is vitiated by the fact that contractions take place in the non-gravid uterus.

(*d*) **Active Foetal Movements.**—1. As an *objective sign*,

active movements of the fœtus afford conclusive evidence of pregnancy. This sign is available by abdominal palpation about the fourth month. It is most promptly elicited by applying the hand cold to the abdomen or by tossing the fœtus from side to side. Muscular movements of the fœtus begin about the tenth week, and sometimes may be detected by the bimanual examination as early as the twelfth. In hydramnios, and in certain other conditions, detection of fœtal movements is difficult and often impossible. In occasional instances they may be absent for a time from no apparent cause.

2. As a *subjective sign* the fœtal movements are not always reliable. In neurotic women they may be simulated by intestinal flatus, spasmodic contractions of the abdominal muscles and certain other conditions.

The sensation of fœtal movements, as first felt by the mother, is termed *quickening*. The period of quickening is usually the end of the fourth month ; yet it varies from the twelfth to the twentieth week. Rarely the fœtal movements are not felt by the mother during the entire period of pregnancy.

(e) **Passive Fœtal Movements ; External Ballottement.**—External ballottement is practised by placing the hands over the sides of the abdomen with their palmar surfaces facing each other and tossing the fœtus from hand to hand. Pathological growths floating in ascitic or other fluid must be excluded.

3. **Auscultation.** (a) The funic or umbilical souffle is a bruit synchronous with the fœtal pulse. It is heard in but few cases, and only in the later months. The bruit results from partial compression of the cord, impeding the blood-current.



(b) **The uterine souffle** is a subdued murmur synchronous with the mother's pulse. It is usually best heard over the lateral aspects of the uterus, especially the left, since owing to the usual right torsion of the gravid uterus the left border is most readily accessible. It is generally audible after the fourth month; it may sometimes be detected earlier by pressing the stethoscope deeply down at the side of the uterus. The sound originates in the ascending uterine arteries and their branches, and not in the placental sinuses, as once believed. It persists after the delivery of the placenta. In other conditions which give rise to enlargement of the uterine arteries and to increased blood-current in these vessels a similar souffle may be heard. Thus the bruit is commonly present with uterine myomata, chronic metritis and even with ovarian cysts.

(c) **The choc fœtal** is the shock of a fœtal movement as perceived by the ear on auscultation of the abdomen over the uterus. It resembles the effect produced by gently percussing one hand held flat against the ear with a finger of the other hand. The *bruit de choc fœtal* is a murmur that immediately precedes the *choc fœtal*, owing to displacement of liquor amnii by the fœtal movements.

(d) **The fœtal heart-tones** are generally perceptible by abdominal auscultation at the fourth or fifth month. By vaginal stethoscopy they may sometimes be heard at the twelfth week.

The heart-sounds resemble those of the newborn infant heard through several thicknesses of clothing. The rate is nearly double that of the maternal pulse, 120 to 150 per minute. They are audible over an area of three inches or more in diameter. The point of greater intensity is termed the focus of auscultation. Usually this nearly overlies the



lower angle of the left foetal scapula. Exceptionally there may be a second focus, even in single foetation, due to conduction through some remote point of foetal contact with the uterine wall. The heart-sounds may for a time be inaudible, owing to dorso-posterior position of the foetus, hydramnios or to other causes. Their persistent absence usually may be taken as evidence of foetal death.

**Method of Examining.**—Place the patient in the horizontal position in a still room. Auscultate by the mediate or the immediate method—in other words, with or without the stethoscope. Listen over the assumed or previously ascertained location of the left foetal scapula. Failing there, search the entire surface of the tumor. Press the abdominal walls firmly against the tumor; a continuous solid medium favors conduction. In dorso-anterior positions, crowding the breech downward in the axis of the foetus helps by arching the child's back forward. Failing, try again at intervals of a few hours or days.

A succession of sounds of the characteristic quality and rhythm, with a rate double that of the maternal pulse, and which can be counted, establishes the diagnosis of pregnancy.

### 3. Pelvic Signs.

(a) **Purplish Color of the Vagina** (*Jacquemin's sign*).—The vagina takes on a purplish hue, which varies greatly in depth in different individuals, and varies in the same individual at different stages of gestation. Usually a venous color is faintly developed by the end of the first month. It is most constantly observed in the anterior vaginal wall immediately below the meatus urethræ. The cause of the deepening color is chiefly, at least, hypertrophy of the corpus cavernosum of the vestibule and of

the vaginal venous plexuses. It is to be found in about 80 per cent. of cases of pregnancy by the end of the third month. Pathological congestion must be excluded, since the color in pregnancy is not distinguishable from that which is produced by pelvic congestion in disease.

**Purplish Color of the Cervix.**—A more or less marked lividity of the vaginal portion of the cervix may be observed almost from the first month after conception. The purplish hue of the cervix is not only developed earlier, but it is more constantly present than is that of the vagina. Here, too, morbid causes must be excluded.

(b) **Softening of the cervix** can usually be made out by the touch at the sixth week. At this early stage of gestation the softened portion is a thin stratum over the lower border of the cervix; it presents the feel of a thin velvety layer covering the firm body of the vaginal portion. As pregnancy advances the cervical softening progresses from below upward and it involves the entire cervix by the end of the eighth month. The cervical canal becomes more patulous as the softening extends. These changes are not always well defined in the early months. Similar softening may arise from pathological causes, but it then lacks the progressive character which belongs to that of pregnancy.

(c) **Changes in the Uterine Tumor.**—The most conclusive evidences of pregnancy in the second and third months are the alterations in *size*, *shape* and *consistence* of the uterus as detected by bimanual examination. The body of the uterus grows with the growing ovum, it takes on an irregularly globular shape and acquires a soft, elastic feel. These changes are well marked by the sixth week and they may sometimes be recognized at an earlier period.

*Most significant are softening and enlargement of the body of the uterus. When relaxed the body is markedly flattened antero-posteriorly, and in the second month much expanded laterally. In contraction, which soon develops under manipulation of the examining fingers, it becomes somewhat globular or ovoid in shape.*

Chronic metritis or subinvolution is distinguished from utero-gestation by greater density, absence of growth and by the history.

An anteflexed and hyperæmic uterus may resemble the gravid tumor in shape and consistence, but it, too, is distinguished from pregnancy by the absence of growth.

A soft submucous fibroid can generally be differentiated by the history and by the slower rate of enlargement.

Hydrometra and hæmatometra present the usual characters of a tense cyst. They are extremely rare.

**Hegar's Sign.**—One of the most striking characteristics of the uterus in the second month of gestation is the compressibility of the isthmus uteri, known as Hegar's sign. It is especially marked in the median portion of the isthmus, which in the non-gravid state is the most dense.

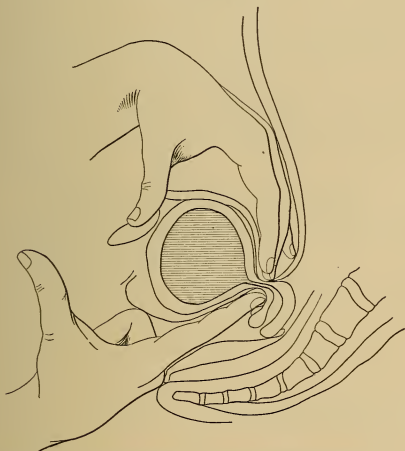
*Method of Examining for Hegar's Sign.*—The patient lies in the lithotomy position. The uterus is depressed by the external hand, or is drawn down with a volsella caught in the cervix. The thumb of the other hand is carried into the vagina and pressed against the lower uterine segment at its junction with the cervix. A finger of the same hand is passed into the rectum to a point just above the utero-sacral cul-de-sac. The uterine tissues between the thumb and finger may be compressed almost to the thinness of a postal card. Thinning under

pressure to less than a half centimeter (0.2 inch) establishes the diagnosis of pregnancy.

The examination may be facilitated by the aid of anæsthesia and by first distending the lower rectum with water.

The compressibility of the isthmus may be made out by catching it between the index finger of one hand in the

FIG. 24.



Bimanual examination for Hegar's sign ; uterus tilted forward. (SONNTAG.)

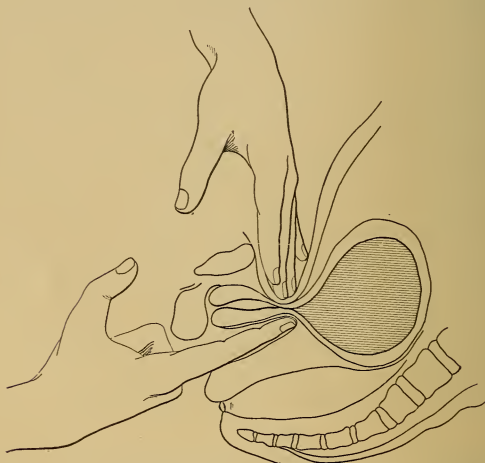
anterior, and of the other in the posterior vaginal fornix, the uterus being drawn gently down with a volsella. Usually it can be done satisfactorily by the ordinary bimanual manipulation.

In examining by conjoined manipulation the uterus may be tilted either forward or backward, and the isthmus thus

be brought between the examining fingers. (Figs. 24 and 25.)

(*d*) **Pulsation of the uterine artery** is perceptible to the touch from the first month of pregnancy. The examining finger is held against the vaginal wall at one side of the

FIG. 25.



Bimanual examination for Hegar's sign; uterus tilted backward. (SONNTAG.)

cervix. Pathological growths may give rise to hypertrophy of the artery and must be excluded.

(*e*) **The temperature of the cervix** is from  $\frac{1}{2}^{\circ}$  to  $\frac{3}{4}^{\circ}$  F., above that of the vagina or the rectum. This may result, too, from local inflammatory causes.

(*f*) **Internal ballottement; passive fœtal movements.**—Ballottement is available during the fifth and sixth months. Earlier the weight of the fœtus is too small,

later generally its mobility is too limited to permit of ballottement.

**Method.**—The patient assumes the reclining (half-sitting) or the erect posture, the bladder must be empty and the clothing loose. Two fingers in the vagina are held against the anterior uterine wall above the cervix, the other hand steadying the fundus. The foetus tossed upward falls again, and taps the finger.

Distinguish from : Anteflexed uterus, a pedunculated tumor of the ovary or uterus, internal projections of large cysts, a floating kidney low-down, stone in the full bladder, pulsation of the uterine artery.

Ballottement may fail from scanty liquor amnii, abdominal presentation of the foetus, placenta prævia, multiple foetation, etc.

#### *Summary of Diagnostic Signs.*

The mammary signs collectively in first pregnancies ;

Detection of foetal parts ;

Active foetal movements ;

Changes in the uterine tumor ;

Internal ballottement ;

Foetal heart.

#### **Abdominal Enlargement from other Causes.**

Abdominal enlargement from other causes than gestation is distinguished from it by the absence of the diagnostic signs of pregnancy, especially those which pertain to the uterus. The non-gravid tumors of the abdomen also present certain characters of their own by which, as a rule, they may be differentiated from gestation.

*Hæmatometra* and *Hydrometra*, which may simulate pregnancy, have already been alluded to.

*Fat* in the abdominal wall may be caught up in folds with the hand and moved about over the underlying muscles, the patient being in the dorsal-recumbent position.

*A phantom tumor* vanishes under anæsthesia.

*Tympanites* usually subsides in the morning, percussion is resonant and palpation negative. The abdominal walls can be pressed backward against the vertebral column. Place the patient in the horizontal position and ask her to breathe deeply. Maintain firm pressure with the fingertips on the abdomen. With each expiration the walls sink deeper until they touch the vertebral column.

*In ascites*, frequently the abdomen is flattened at the umbilicus when the patient lies in the horizontal position. Percussion is tympanitic at the summit of the tumor, except in rare instances, in which the mesentery is too short to permit flotation of the intestines to the surface of the fluid. There is dullness throughout the flanks.

A fluid wave can be transmitted through all parts of the tumor within the limits of the fluid. In pregnancy the wave is intercepted by the fœtus. The fluid-level changes with the posture of the patient.

In ascites evidence usually may be detected of the pathological condition which has given rise to the hydro-peritoneum.

*Tumors of other organs* may be traced to the normal location of those organs, and the uterus is readily differentiated from the tumor.

*In ovarian cystoma*, as a rule, there is more pronounced fluctuation than in the tumor of pregnancy. There is, too, absence of fœtal parts, of active fœtal movements and of the fœtal heart. In most cases the uterus may be mapped out apart from the tumor. The menses are usually not absent.



*Uterine myomata*, when of the submucous variety, are distinguished from pregnancy by menorrhagia and generally by greater density.

Subperitoneal myomata are distinguished by the nodular character of the tumor.

The growth in either variety is not so rapid as in gestation and the uterus is denser than in pregnancy. Pregnancy sometimes coexists with myomata or other pelvic or abdominal neoplasms, and then is often extremely difficult of recognition.

It must be remembered that a uterine bruit like that of pregnancy may be heard in a myomatous uterus.

### Multiple Pregnancy.

Twins occur once in about eighty or ninety pregnancies, triplets once in seven or eight thousand. Quadruple and even quintuple pregnancies are sometimes met with. A case of sextuple pregnancy is recorded.

Multiple foetation borders on the pathological. The viability of the children is lower than in single pregnancy. Usually the foetuses are of undersize and of unequal development. Acephalous monstrosity and malpresentation are more common than in single pregnancy. Death of one or both in utero is not infrequent. Generally twin pregnancy is attended with excess of liquor amnii. In two-thirds of the cases labor comes on prematurely.

**Origin of Multiple Pregnancy.**—Multiple pregnancy may result from rupture of two or more Graafian follicles at the same menstrual period, either in the same or in different ovaries, from two ova in one follicle, or from a single ovum with a double germ. Children from the

same ovum are always of the same sex. Hence the members of a double monstrosity are alike in sex.

*Arrangement of the Membranes and Placentas.*—In twin foetation from separate ovules there are two amnions, two chorions and two placentas. The placentas may be separate or fused at their margins. In either case they have independent circulations.

In twin pregnancy from a single ovum having a double germ there is a single chorion containing two amnions; almost invariably the placenta is single. Rarely two foetuses are found in a common sac, the amniotic septum having been destroyed.

**Superfecundation.**—Superfecundation is a twin pregnancy resulting from separate acts of insemination by the same or different males of ova expelled at the same period of ovulation.

**Superfoetation.**—This term was formerly applied to a twin pregnancy which was believed to result from the impregnation of two separate ova thrown off at different periods of ovulation. Supposed cases of this character are doubtless to be explained as twin pregnancies in which one foetus is blighted.

### Duration of Pregnancy.

The duration of pregnancy is not definitely known, and it probably never can be, since the time of fecundation is unknown.

The average period between the beginning of the last menstruation and labor is two hundred and eighty days, practically ten menstrual months.

The average interval between the fruitful coitus and the birth of the child is two hundred and seventy-three days.

Variations of twenty days above or below these averages are doubtless possible within physiological limits. Much variation, however, in the actual period of gestation, with the exception of cases in which the pregnancy is cut short by accident, is probably extremely rare. The term of pregnancy is frequently shortened a few days, or even one or two weeks, with nothing in the character of the labor or the appearance of the child which would suggest to casual examination a premature birth. So insecure is the attachment of the ovum in the last week or two of gestation that doubtless labor is established prematurely in a large proportion of instances. On the other hand the pregnancy may appear to be prolonged when in reality the actual term of gestation has not exceeded the usual normal limit. It is not infrequently the case that conception dates, not from the end of the week following the beginning of the last menstrual flow as is usually the rule, but from some later period in the month. An error of two or three weeks in the count often is thus possible.

#### **Rules and Methods for Predicting the Date of Labor.**

(a) *Naegele's Rule*.—Compute nine calendar months from the beginning of the last menstrual period and add seven days. This is a ready method of reckoning approximately two hundred and eighty days from the beginning of the last menstruation. For predicting the date of labor it is generally accurate within a week. It is subject, however, to the fallacies already pointed out.

Reckoning from the date of quickening is not reliable. The period of quickening is not constant. It varies in different individuals, and even in the same individual in different pregnancies. Moreover, the observations of the patient in this matter are often fallacious.

(b) *Mensuration of the uterus* is not a wholly reliable basis for prediction, since the quantity of liquor amnii varies in different cases and the size of the foetus at a given period of gestation is not constant.

*Situation of the Fundus.*—The fundus uteri is in the plane of the brim at the third month, at the umbilicus about the sixth and reaches the ensiform cartilage at eight and one-half months. At lightening it sinks to a little lower level. Accuracy here, too, is vitiated by the causes just mentioned and also by the fact that the umbilicus is not a fixed point.

(c) *Mensuration of the Foetus.*—The total length of the foetus is about double that of the foetal ovoid. The latter may be measured with sufficient accuracy with a pelvimeter, placing one knob in contact with the lower foetal pole through the vagina and the other upon the abdomen over the upper pole, or measuring externally, through the abdominal wall. The rate of foetal development, however, is not uniform; extreme accuracy of measurement, too, is impossible. Yet this measurement together with the diameters of the head affords fairly reliable data for estimating the stage of pregnancy.

### Length of the Foetus.

The approximate lengths of the child in different stages of intrauterine development during the later months of gestation are as follows :

Sixth calendar month, 30 to 35 cm., 12 to 14 inches.

Seventh calendar month, 35 to 40 cm., 14 to 16 inches.

Eighth calendar month, 40 to 45 cm., 16 to 18 inches.

Ninth calendar month, 45 to 50 cm., 18 to 20 inches.

### HYGIENE OF PREGNANCY.

The patient should seek the advice of her physician from the early months of gestation. She should consult him on even slight departures from health and especially during the later months.

**Hygienic Requirements** are: Exercise in the open air an hour or two daily, with care to avoid over-exertion and exhaustion; the avoidance, if possible, of all injurious mental influences; the observance of regular hours for meals; proper quantity and kind of food; daily bowel movements; eight hours sleep daily; pure air constantly; a tepid or cold sponge-bath daily.

The teeth are especially prone to decay during pregnancy and special care, should, therefore, be given them. They should be cleansed on rising and retiring and after each meal. Occasional inspection by the dentist is advisable.

In cases of irritating leucorrhœal secretions a vaginal injection of a quart of water at a temperature of 98° F., or of a borax solution, ʒss ad Oj, may be used once or twice daily. The temperature of the douche should be that of the body and the injection must be given with the least possible force lest it provoke abortion.

**Diet.**—The diet throughout pregnancy should consist of easily digestible food and the quantity should be moderate. Milk, eggs, bread, fruits, with fish occasionally, are suitable. Meat should not be taken oftener than once daily. Fried dishes, pastry, and rich food of whatever description should be avoided.

**Clothing.**—In our climate light flannel underwear is essential at all seasons; the outer clothing must be changed

to suit changing temperatures. A rational method of dress requires no more clothing for indoor use in the winter months than would be needed at the corresponding temperature in the summer season. For outdoor use extra wraps are called for according to the degree of exposure to cold.

The clothing must not be tight, especially about the breasts and abdomen, and the heavier garments should be suspended from the shoulders.

**Care of the Nipples.**—It is a useful practice to cleanse the nipples daily with a borax solution, ʒss ad Oj, during the last two months of pregnancy. They may be anointed with fresh cacao butter after cleansing, and if they are small or sunken the patient should be taught to draw them out with the thumb and fingers. Astringent applications such as are frequently employed with a view to hardening the nipples doubtless tend rather to promote cracking during lactation than to prevent it. The better practice is to keep them supple by the use of inunctions. The manipulation referred to not only helps to develop the nipples when this is required but it has the further effect of inuring them to nursing.

**The Urine.**—The urine should be examined chemically and microscopically at least once monthly during the first seven months, once a week during the last two months, oftener in the presence of toxæmia, œdema, of renal insufficiency or evidence of nephritis.

In all observations of the urinary excretion the specific gravity and the quantity passed daily are essential as indicating the extent to which toxic material is being eliminated. It should not be less than 50 or 60 ounces. Quantitative tests for urea afford the best evidence of

the functional activity of the kidneys. The average normal quantity of urea daily is about 33 grammes, 500 grains, of the total solids daily about 66 grammes, 1000 grains. The total solids may be roughly estimated by multiplying the last two figures in the number indicating the specific gravity by the number of ounces of urine and the product by 1.10. For the estimation of urea Bartley's method is recommended.<sup>1</sup>

When the daily quantity of urine falls below 60 ounces the ingestion of a larger quantity of water is indicated.

**Marital Relations.**—Marital relations are to be restricted, particularly at the menstrual dates. Violation of this rule is a common cause of abortion and of premature labor. The nausea of pregnancy is often aggravated by this cause.

<sup>1</sup> Bartley's Medical Chemistry.

## CHAPTER III.

### PHYSIOLOGY OF LABOR.

#### 1. THE MECHANICAL FACTORS OF LABOR.

THREE factors are concerned in the mechanism of childbirth, the powers, the passages and the passenger.

##### 1. The Expelling Powers.

The expelling powers are :

1. *The Muscular Action of the Uterus.*—This is involuntary, the motor apparatus of the uterus being chiefly controlled by the sympathetic nervous system. The uterine contraction is peristaltic, yet practically simultaneous ; it begins at the fundus probably.

2. *The action of the abdominal muscles*, which is partly voluntary, partly a reflex, involuntary contraction.

In the expulsive stage of labor the contractions of the abdominal muscles are usually brought into play independently of volition. Their force may generally be augmented by voluntary effort. They have the effect to increase the intra-abdominal pressure and thus to reinforce the expulsive action of the uterus.

The chief expellant force is the contraction of the uterus. Contractions of the muscular elements of the round and of the broad ligaments take place at the same time with the uterine contraction. They help to steady the uterus in the axis of the pelvis.



*The power of the uterine contraction* reinforced by that of the abdominal muscles according to Duncan is 50 to 80 pounds ; according to Schatz it is from 17 to 55 pounds.

## 2. The Passages.

The passages include : 1. The hard parts of the bony pelvis. 2. The soft parts, consisting of the uterus, the pelvic floor and the structures which line the osseous portion of the birth-canal.

### Obstetric Anatomy of the Bony Pelvis.

**The Pelvis.**—The pelvis is a strong, bony basin, whose cavity is the most important portion of the parturient tract.

The *constituent parts* of the bony pelvis are the two ossa innominata, the sacrum and the coccyx.

**The joints** are the symphysis pubis, the sacro-iliac joints and the sacro-coccygeal joint. A slight mobility of the pubic and the sacro-iliac joints is usually present in the later months of gestation. The capacity of the pelvis is thus a little larger than in the non-gravid state.

Extension of the thighs moves the upper end of the sacrum backward and favors the passage of the head through the pelvic brim. The escape of the head from the pelvis at a later stage of the labor is promoted by flexion of the thighs upon the abdomen, which carries the lower end of the sacrum backward.

Recession of the coccyx to the extent of 12 mm. to 25 mm.,  $\frac{1}{2}$  to 1 inch, occurs during the expulsion of the foetal head from the outlet.

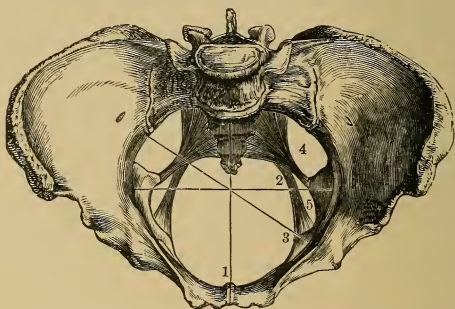
**The false pelvis or greater pelvis** is that portion of the pelvis above the ilio-pectineal line. It forms with the

lower part of the abdominal wall a funnel-shaped approach to the true pelvis.

The true pelvis or lesser pelvis is the part of the pelvis below the ilio-pectineal line. It is with this that obstetric questions are mainly concerned.

The brim, inlet, superior strait, margin or isthmus of the pelvis is located by the ilio-pectineal line and the upper margin of the sacrum. Usually it is approximately heart-shaped. Sometimes it is oval or nearly round.

FIG. 26.



Brim of pelvis. 1. True conjugate. 2. Transverse diameter. 3. Oblique diameter. 4. Greater sacro-sciatic foramen. 5. Lesser sacro-sciatic foramen.

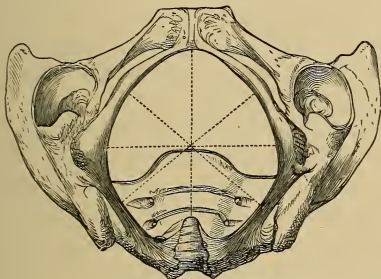
*Obstetric landmarks* at the brim are: (1) The sacral promontory or sacro-vertebral angle; (2) The sacro-iliac joints; (3) The ilio-pectineal eminences, which are situated at the ilio-pubic joint, on the pubic bone; (4) The symphysis pubis.

The outlet of the pelvis, or inferior strait, is lozenge-shaped, and is located by the tip of the coccyx, the sub-pubic arch and the ischial tuberosities. It is made up of two obtuse-angled triangles, whose common base is a line

joining the ischial tuberosities ; the apex of the one is the summit of the subpubic arch ; the apex of the other is the tip of the coccyx.

*Obstetric landmarks* at the outlet are : (1) The tip of the coccyx ; (2) The subpubic arch, formed by the descending rami of the pubic bones ; (3) The ischial tuberosities ; (4) The ischial spines ; (5) The greater and the lesser sacro-sciatic ligaments which help to supplement the bony canal.

FIG. 27.



Outlet of pelvis.

The greater sacro-sciatic ligaments spring from the posterior-inferior spines of the ilium and from the sides of the sacrum and the coccyx and are inserted into the inner surfaces of the ischial tuberosities.

The lesser sacro-sciatic ligaments lie in front of the greater. They arise from the sides of the sacrum and the coccyx and are inserted into the ischial spines. The open space between the lesser sacro-sciatic ligament and the ilium and ischium is the greater, that between the two ligaments and the bone in front is the lesser sacro-sciatic foramen.

L. of C.

The greater sacro-sciatic foramen transmits the pyramiformis muscle, and the gluteal, the sciatic and the pubic vessels and nerves.

The lesser sacro-sciatic foramen transmits the tendon of the obturator internus muscle and the internal pudic vessels and nerves.

**The cavity of the pelvis** is bounded posteriorly mainly by the sacrum and the coccyx; anteriorly by the pubic bones and the ischio-pubic rami; laterally by the surfaces of the iliac and the ischial bones.

The posterior wall is smooth, and is concave from above downward, a fact which favors the descent of the posterior pole of the foetal head or other presenting part. The depth of the posterior wall is 12.5 cm., 5 inches; if measured on the curve of the sacrum and coccyx, 14 cm.,  $5\frac{1}{2}$  inches. The anterior wall is smooth and concave from side to side. This favors the lateral rotation of the head in its screw-like descent through the pelvis. At the symphysis pubis the depth is 4.4 cm.,  $1\frac{3}{4}$  inch. The lateral wall is 9 cm.,  $3\frac{1}{2}$  inches, deep.

The obturator foramen, situated in the anterior wall of the pelvis, is bounded by the bodies and the rami of the ischium and pubis. The bony opening is closed by the obturator membrane, except at the obturator canal. The canal transmits the obturator nerve and vessels.

### Planes of the Pelvis.

1. **The plane of the brim** cuts the ilio-pectineal line and the upper margin of the sacrum. In the erect posture of the woman the average inclination of the brim to the horizon is about  $60^{\circ}$ .

2. **The middle plane** cuts the middle of the posterior

surface of the pubic symphysis and the upper border of the third sacral vertebra.

3. **The plane of the outlet** cuts the tip of the coccyx, the ischial tuberosities and the lower end of the symphysis pubis. The inclination of the plane of the outlet to the horizon is  $11^{\circ}$ , the summit of the subpubic arch being below the level of the tip of the coccyx.

Practically the plane at which the head escapes from the grasp of the bony pelvis is a plane cutting the tip of the sacrum and a point just above the lower end of the symphysis.

**Pelvic Diameters. Internal Diameters.**—(a) At the brim :

1. *True conjugate*, from the promontory of the sacrum to the upper end of the symphysis, more exactly to the point at which the symphysis is crossed by the prolongation of the linea ilio-pectinea.

2. *Diagonal conjugate*, from the summit of the subpubic arch to the sacral promontory.

3. *Transverse diameter*, the greatest transverse diameter of the pelvic brim ; it terminates at a point midway between the sacro-iliac joint and the ilio-pectineal eminence on either side.

4. *Oblique diameters*, extending each from one sacro-iliac joint, to the opposite ilio-pectineal eminence ; R. O. from the right, L. O. from the left sacro-iliac joint.

(b) At the middle plane :

1. *Antero-posterior diameter*, from the upper margin of the third sacral vertebra to the middle of the posterior surface of the pubis.

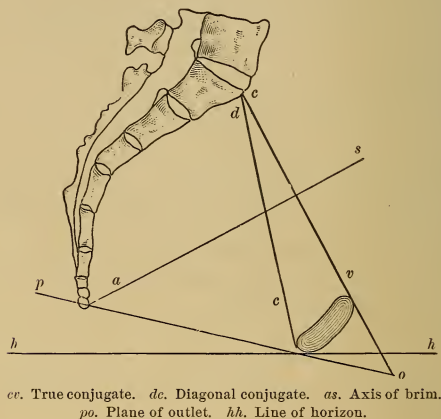
2. *Transverse diameter*, terminating in points corresponding to the lower margins of the acetabula.

3. *Oblique diameters*, each from the center of one greater sacro-sciatic foramen to the center of the obturator membrane diagonally opposite.

(c) At the outlet :

1. *Antero-posterior diameter*, from the lower end of the symphysis pubis to the tip of the coccyx, practically to the tip of the sacrum.

FIG. 28.



2. *Transverse diameter*, the distance between the tubera ischiorum, the bisischial diameter.

3. *Oblique diameters*, each from the middle of the lower edge of the greater sacro-sciatic ligament on one side to the point of union between the ischium and pubis on the opposite side.

**External Diameters.**—1. *External conjugate diameter*, or diameter of Baudelocque, from the depression or fossa just below the spinous process of the last lumbar vertebra

to the most prominent point on the surface overlying the upper portion of the pubic symphysis, nearly parallel with the internal conjugate. To locate the spine of the last lumbar vertebra draw an imaginary line connecting the depressions corresponding to the posterior-superior iliac spines. The second spinous process above the level of this line is that of the last lumbar vertebra.

2. *Ilio-spinal or interspinal diameter*, the distance between the anterior-superior spines of the ilia measured from the outer borders of the sartorius muscles at their origins.

3. *Ilio-cristal or intercristal diameter*, in the normal pelvis the greatest transverse width of the pelvis at the crests.

#### Approximate Measurements of the Static or Dried Pelvis.

##### Internal Diameters.

ANTERO-POSTERIOR.	OBLIQUE.	TRANSVERSE.
Brim, 4 inches.	$4\frac{1}{2}$ inches.	5 inches.
Cavity, $4\frac{1}{2}$ "	$4\frac{1}{2}$ "	$4\frac{1}{2}$ "
Outlet, 5 "1	$4\frac{1}{2}$ "	4 "

These values correspond nearly to 10, 11.5 and 12.5 cm.

At the brim the right oblique diameter is slightly longer than the left oblique. The average measurements at the brim are more accurately as follows:

CONJUGATE.	OBLIQUE.	TRANSVERSE.
10 cm., 4 in.	12.5 cm., 5 in.	13.5 cm., $5\frac{1}{4}$ in.

The *circumference* of the brim is about 40 cm., 16 in.; of the outlet, 33 cm., 13 in.

#### Approximate Measurements of the Dynamic Pelvis.

##### Internal Diameters.

The internal diameters are all reduced 6 mm.,  $\frac{1}{4}$  in., by the presence of the soft structures in the dynamic pelvis.

<sup>1</sup> Distance from lower end of symphysis pubis to tip of sacrum 12.5 cm., 5 in.; to tip of coccyx, 9.5 cm.,  $3\frac{3}{4}$  in.; when coccyx is pushed back, 11.5 cm.,  $4\frac{1}{2}$  in.



The transverse diameter at the brim is still more diminished by the psoas and iliacus muscles, so much so that the oblique is the longest diameter in the dynamic pelvis.

### External Diameters.

External conjugate . . . . .	20	cm.,	8	inches.
Interspinal . . . . .	25.5	"	10	"
Intercristal . . . . .	28	"	11	"

To estimate the internal conjugate from the external deduct 7 to 12.5 cm.,  $2\frac{3}{4}$  to 5 inches, according to the estimated thickness of the overlying bony and soft parts.

*The average external circumference* of the pelvis measured over the symphysis and on a line running just below the iliac crests and across the middle of the sacrum is nearly 1 meter (little more than one yard).

### Difference between the Male and the Female Pelvis.

#### *Distinguishing Marks of the Female Pelvis.*

*As a Whole.*—The greater pelvis is wider; the lesser pelvis is larger in all its diameters and of shallower depth. The bones are lighter and are more slender. The inclination of the pelvis is greater.

*The Brim.*—The shape is less triangular. The sacro-vertebral angle is more pronounced and more prominent. The pubic spines are more widely separated.

*The Cavity* is not so funnel-shaped. The sacrum is shorter and broader and more strongly curved.

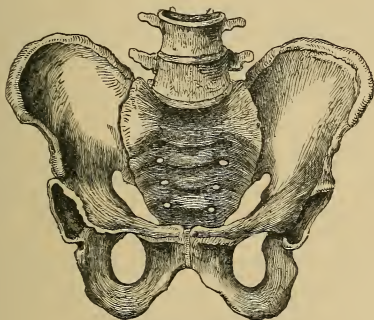
*The Outlet.*—The subpubic angle is greater— $90^\circ$ , the angle in the male being  $70^\circ$ . The depth of the symphysis pubis is little more than half that in the male.



## Obstetric Anatomy of the Pelvic Soft Parts.

The transverse diameter of the *brim* is somewhat diminished by the iliacus and psoas muscles. They encroach

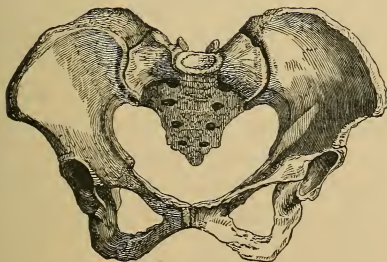
FIG. 29.



Male pelvis.

upon the lateral margins of the inlet to the extent of a quarter of an inch or more on each side. The external iliac vessels run along the inner borders of these muscles.

FIG. 30.



The female pelvis.

In the *cavity* no muscular structures overlie the median portion of either the anterior or posterior pelvic wall. On either side of the median section are the piriformis muscle posteriorly and the obturator internus anteriorly and laterally, too thin to affect the pelvic diameters.

*The piriformis* arises by a series of digitations from the lateral aspects of the sacrum anteriorly and from the upper portion of the sacro-sciatic ligament, and its fasciculi converge to pass out through the greater sacro-sciatic foramen.

*The obturator internus* arises from the circumference of the obturator foramen and the inner surface of the obturator membrane; its fibers converge to a tendon which passes through the lesser sacro-sciatic foramen.

The *outlet* of the pelvis is closed by the pelvic floor or diaphragm, which is made up chiefly of muscles and fasciæ.

**The Pelvic Floor.**—The upper aspect of the pelvic floor is concave; its lower, convex from before backward.

It is limited above by the peritoneum, except where that structure is lifted to be reflected over the pelvic viscera and their appendages. Its inferior surface is skin.

Its median portion is obliquely traversed by three muscular slits, the urethra, the vagina, the rectum. These canals are approximately parallel with the plane of the pelvic brim, except that the end of the rectum turns backward nearly at a right angle with the vagina.

The posterior vaginal wall and the soft structures behind it make the sacral segment of the pelvic floor; the anterior wall of the vagina and the soft parts in front of it constitute the pubic segment of the pelvic floor. (Hart.)

*Measurements.*—Coccyx to anus, in the nullipara, 4.5 cm.,  $1\frac{3}{4}$  in.; anus to lower edge of vulvar orifice, in the

nullipara, 3.1 cm.,  $1\frac{1}{4}$  in.; in the parous woman, 2.5 cm., 1 in.; in the primigravida at term, 3.8 cm.,  $1\frac{1}{2}$  in.

Greatest transverse width on the bisischial line, 10.7 cm.,  $4\frac{1}{4}$  in. Perpendicular thickness of the pelvic floor at the anus, 5 cm., 2 in.

In the nullipara the average projection of the pelvic floor below a line drawn from the tip of the coccyx to the lower end of the symphysis is 2.5 cm., 1 in.; in the parous woman at term, 9.5 cm.,  $3\frac{3}{4}$  in.

The length of the sacral segment during labor at the moment of expulsion, coccyx to lower edge of the vulvar orifice, is 15 to 17.5 cm., 6 to 7 in.

#### Principal Component Structures.

**Fascial Sheets of the Pelvic Floor.**—The most important supporting structures of the pelvic floor are its fascial sheets. Upon these the strength of the pelvic diaphragm almost wholly depends.

**Recto-vesical or Visceral Fascia.**—It will be remembered that the parietal fascia of the lesser pelvis is continuous with the iliac fascia and covers the obturator and the pyriformis muscles. From this is given off a transverse layer which stretches across the pelvis. This is the recto-vesical fascia. Its line of attachment to the parietal fascia is the white line, or arcus tendineus. The white line extends from the ischial spine to the posterior aspect of the body of the pubis, arching downward. Its greatest distance below the ilio-pectineal line is about 5 cm., 2 in.

At the lateral walls of the bladder, the vagina and the rectum, this fascia divides into four layers (Webster):

1. *Vesical Layer.*—This layer runs upward on each lateral aspect of the bladder to form the lateral true ligaments of the bladder.

2. *Vesico-vaginal Layer*.—This layer runs between the bladder and the anterior vaginal wall.

3.° *Recto-vaginal Layer*.—This layer extends between the lower portion of the vagina and the rectum, blending below with the connective tissue of the perineal body.

4. *Rectal Layer*.—This layer envelops the lower end of the rectum posteriorly, being closely attached to its posterior wall.

The anal fascia covers the inferior surface of the levator ani muscles, presently to be described.

**The Triangular Ligament.**—Across the triangular space between the ischio-pubic rami and in front of the bisischial line are stretched the two fascial sheets which constitute the triangular ligament. The deep layer of the triangular ligament blends with the parietal fascia and is in contact with the inferior surface of levator ani muscle, fusing with its fascial sheath. The two layers blend at the bisischial line with each other and with the superficial fascia. The union of these layers at the bisischial line forms the *perineal ledge* or *ischio-perineal ligament*. These three sheets are sometimes described as the deep, the middle and the superficial layers of the perineal fascia. They are perforated by the urethra and the vagina. Between the middle and the superficial layers of the perineal fascia are the superficial transversus perinei, the bulbo-cavernosus and the ischio-cavernosus muscles, on either side.

### Muscles of the Pelvic Floor.

**Levator Ani.**—The anatomy of this muscle, according to Browning, who was the first to describe it correctly, is as follows :

It immediately underlies the recto-vesical fascia. It consists of three parts. The first takes its origin from the posterior surface of the os pubis and from the deep layer of the triangular ligament; the second from the white line; the third from the ischial spine. The bony origin of the pubic bundle is about 12 mm.,  $\frac{1}{2}$  inch, from the symphysis and 3.5 cm.,  $1\frac{1}{8}$  inch, below the upper border of the bone. The entire pubic bundle is about 12 mm.,  $\frac{1}{2}$  inch, wide and 3 mm.,  $\frac{1}{8}$  inch, thick at a point just beyond its origin. Its course is nearly horizontally backward. Its superficial fibers blend with those of the external sphincter ani. Of the deeper fibers a few turn forward into the perineal body. The greater number take a backward course toward the coccyx, to which most of them can be traced. Some of the fibers in their course toward the coccyx lie in close proximity to the median line, but none are continuous with their fellows of the opposite side. The pubic bundle as it sweeps by the vagina is 5 mm.,  $\frac{1}{4}$  inch, away from it.

The part of the muscle which arises from the white line is thin and membranous and is weakly attached to it. The direction of its fibers is at first downward, inward and backward toward the rectum and the rectococcygeal raphé. They all fall short of the rectum and the raphé, turning toward the coccyx, most of them reaching it, some first becoming aponeurotic.

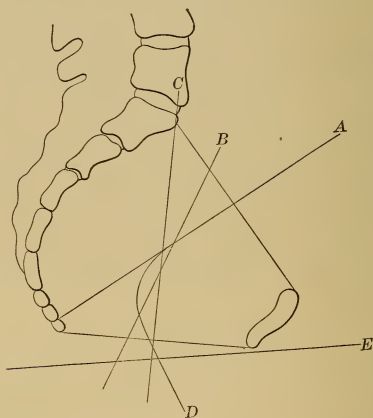
The part of the levator which springs from the ischial spine forms a small spindle-shaped bundle. Its course is nearly transverse. The most of its fibers are inserted into the tip of the coccyx; a few turn forward upon the rectococcygeal raphé.

Nowhere do the fibers of the levator cross the median line to join those of its fellow on the opposite side.

The *anal fascia* on the lower and a very thin fascial layer on the upper surface of the levator constitute its sheath. These are separable from the contiguous fascial sheets previously described.

**Superficial Transversus Perinei.**—Origin, the inner aspect

FIG. 31.



Axes of the pelvis. A. Axis of superior plane. B. Axis of mid-plane. C. Axis of inferior plane. D. Axis of canal. E. Horizon. (PLAYFAIR.)

of the tuberosity and ramus of the ischium ; insertion, the center of the perineal body.

**The deep transversus perinei** lies between the deep and the middle layers of the perineal fascia. It takes origin from the descending ramus of the pubis, and is inserted into its companion muscle.

**Bulbo-cavernosus.**—Origin, the external sphincter ani and the perineal fascia at one side of it; insertion, by three slips, one into the posterior surface of the bulb, one into the lower aspect of the clitoris and one into the vestibular mucous membrane.

**Ischio-cavernosus.**—Origin, the tuberosity of the ischium and ischio-pubic ramus; insertion, the crus clitoridis and an aponeurosis covering the posterior part of the body of the clitoris.

The **sphincter ani externus** is made up of two semilunar bands, each about 3 cm.,  $\frac{1}{2}$  inch, wide, one on either side of the anus. Origin, the tip of the coccyx and the skin adjacent thereto; insertion, the tendinous center of the perineal body.

The **perineal body**, so called, is the body of elastic and muscular tissue between the lower end of the rectum and the vagina. Its height is 3.7 cm.,  $1\frac{1}{2}$  inch, its transverse width 3.7 cm.,  $1\frac{1}{2}$  inch, and the length of its base antero-posteriorly 3.1 cm.,  $1\frac{1}{4}$  inch, in the nullipara.

### The Parturient Axis.

The *axis of the brim* is a line perpendicular to the plane of the inlet at its central point; its prolongation passes through the umbilicus and the tip of the coccyx. It is coincident with the axis of the uterus at term.

The *axis of the outlet* is the perpendicular to the plane of the outlet at its midpoint. Prolonged it cuts the lower border of the first piece of the sacrum.

The *axis of the outlet of the soft parts*, the line of expulsion, looks almost directly forward.

The *parturient axis* is made up of the axes of the several planes of the birth-canal. It is an irregular parabola.



### 3. The Passenger.

#### Obstetric Anatomy of the Fœtal Head.

For the obstetrician the fœtal head presents two divisions: (1) The cranial vault. (2) The cranial base and face. The former, owing to the semi-cartilaginous character of its bones and to their mobility, is plastic, a fact of importance in facilitating the passage of the head through the pelvis; the latter is unyielding, its bony structures being more highly ossified and more firmly united. Protection is thus afforded during labor to the vulnerable structures at the base of the brain. It is with the cranial vault that obstetric problems have mainly to do.

*The cranial vault* comprises the parietal, the frontal and the squamous portions of the occipital and the temporal bones.

*The cranial base* is composed of the basilar portion of the occipital bone, the petrous portion of the temporal bones and of the entire sphenoid and ethmoid bones.

**The Sutures.**—The sutures are the membranous interspaces between two adjacent cranial bones. Of special obstetric importance are the following:

- The sagittal or inter-parietal suture;
- The frontal or inter-frontal suture;
- The coronal or fronto-parietal suture;
- The lambdoidal or occipito-parietal suture.

**The Fontanelles.**—The fontanelles are the membranous spaces between the angles of three or four adjacent bones of the cranium. The fontanelles of obstetric interest are two, the anterior and the posterior.

*The anterior or large fontanelle* or bregma is situated at the anterior end of the sagittal suture. In the vaginal

examination during labor it is identified by the following characters :

- (1) It is kite-shaped or quadrangular, its most acute angle looking forward ;
- (2) its average diameter is 2.5 cm., 1 in.;
- (3) four sutures run into it.

*The posterior fontanelle* lies at the posterior end of the sagittal suture. To the examining finger it presents the following distinguishing marks :

- (1) It is triangular ;
- (2) it is small, usually a mere depression scarcely perceptible to the finger-tip ;
- (3) three sutures run into it ;
- (4) immediately behind it is the squamous or triangular portion of the occipital bone which is hinged to the basilar portion by a movable joint of fibrous tissue.

**Protuberances.**—The foetal head presents five protuberances which are of interest as obstetric landmarks viz., one occipital, two parietal and two frontal.

*The occipital protuberance* is situated on the occipital bone an inch or more behind the posterior fontanelle.

*The parietal protuberance* or boss on either side of the cranium is the eminence at the center of the parietal bone.

*The frontal protuberance* is the prominence at the central portion of each frontal bone.

**The Vertex.**—The vertex is that part of the cranial vault lying between the fontanelles and extending laterally to the parietal eminences.

**The Occiput.**—The occiput is the portion of the cranium behind the posterior fontanelle.

**The Sinciput.**—The sinciput is that portion of the cranial vault lying in front of the bregma.

### *Measurements of the Foetal Head.*

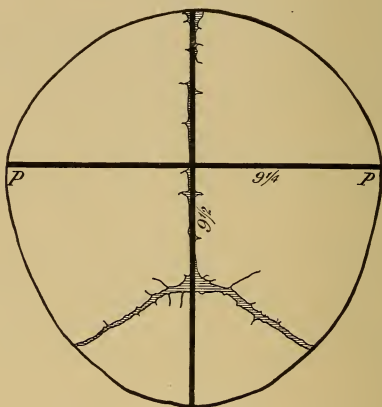
The *biparietal diameter* is the greatest transverse width

of the head measured through the parietal eminences ; its value is 9.5 cm.,  $3\frac{3}{4}$  inches.

The *fronto-mental diameter* extends from the summit of the forehead to the center of the lower margin of the chin. Its value is 9 cm.,  $3\frac{1}{2}$  inches.

The *trachelo-bregmatic diameter* is measured from the

FIG. 32.



Fœtal head viewed from behind. PP. Biparietal diameter. (After FARABEUF.)

neck just above the larynx to the center of the bregma ; its value is 9.5 cm.,  $3\frac{3}{4}$  inches.

The *occipito-frontal diameter* is the distance from the tip of the occipital protuberance to the root of the nose ; its value is 11.5 cm.,  $4\frac{1}{2}$  inches.

The *occipito-mental diameter* is measured from the summit of the occipital protuberance to the center of the lower margin of the chin ; its value is 14 cm.,  $5\frac{1}{2}$  inches.

The *suboccipito-bregmatic diameter* is the distance from

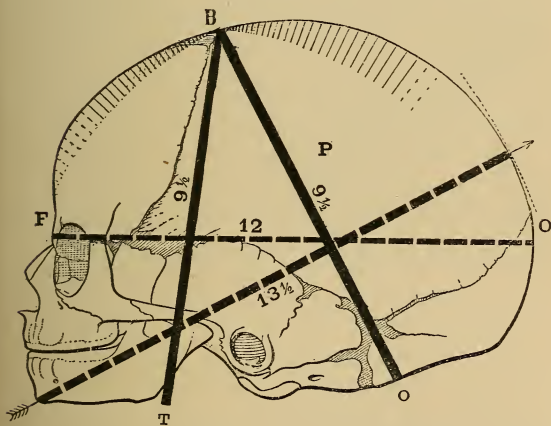
the junction of the nucha and the occiput to the center of the bregma; its value is 9.5 cm.,  $3\frac{3}{4}$  inches.

The *bitemporal diameter* is the transverse diameter of the head between the lower extremities of the coronal suture; its value is 8 cm.,  $3\frac{1}{8}$  inches.

The *bimastoid diameter* is the greatest distance between the mastoid apophyses; its value is 7 cm.,  $2\frac{3}{4}$  inches.

*Circumference.*—The suboccipito-bregmatic circumference is measured over the junction of the nucha and

FIG. 33.



Fœtal head viewed from the side. OF, Occipito-frontal diameter. OB, Suboccipito-bregmatic diameter. TB, Trachelo-bregmatic diameter. (After FARA-BEUF.)

occiput and over the center of the bregma; its value is about 33 cm., 13 inches, in male, 1.2 cm.,  $\frac{1}{2}$  inch, less in female heads.

It will be seen that the principal diameters of the fœtal

head, namely, the biparietal, the occipito-frontal and the occipito-mental, are approximately  $3\frac{1}{2}$ ,<sup>1</sup>  $4\frac{1}{2}$ ,  $5\frac{1}{2}$  inches respectively. The fronto-mental diameter, too, is  $3\frac{1}{2}$  inches.

### Trunk Diameters.

The *bisacromial diameter* is 12 cm.,  $4\frac{3}{4}$  inches. The *bitrochanteric* is 8.8 cm.,  $3\frac{1}{2}$  inches. The trunk diameters are much more compressible than are the cephalic.

### Presentation, Position and Posture of the Fœtus.

**Presentation.** **Definition.**—By presentation is meant the relation of the long axis of the foetal ovoid to the uterine axis.

#### Varieties :

#### 1. *Longitudinal.*

##### A. Cephalic,

- a. Vertex ;
- b. Face ;
- c. Brow.

##### B. Pelvic,

- a. Breech ;
- b. Feet.

#### 2. *Transverse.*

- a. Shoulder ;
- b. Arm ;
- c. Hand.

The *presenting part* is that part of the foetal ovoid which offers to the examining finger within the girdle of resistance.

*Relative Frequency of Presentations.*—In at least 96 per cent. of all term labors the foetus presents by the cephalic extremity. Breech or pelvic presentation occurs in 3 per cent. of term births, lateral in about 1 per cent. The face

<sup>1</sup> More exactly  $3\frac{3}{4}$  inches.

or brow is the presenting part in a little less than  $\frac{5}{10}$  per cent. of cephalic births. The preponderance of cephalic presentation is mainly due to adaptation; the foetal mass tends to accommodate its position to the shape of the uterus.

**Position.**—Position is the relation of the presenting part to the quadrants of the pelvic brim. These quadrants are the left anterior, the right anterior, the right posterior and the left posterior quadrant of the brim. The positions are named according to the particular quadrant which the leading anatomical landmark on the presenting part confronts. For each presenting part there are, therefore, four possible positions.

Vertex positions are named according to the quadrant which the occiput confronts. When the occiput looks toward the left anterior quadrant the position is left occipito-anterior; when toward the right anterior quadrant the position is right occipito-anterior and so on.

Face positions are named in like manner, according to the direction of the chin; breech positions with reference to the direction of the sacrum, and shoulder positions to that of the scapula.

Thus we have the following positions:

*Vertex Positions.*

Left occipito-anterior—L. O. A.

Right occipito-anterior—R. O. A.

Right occipito-posterior—R. O. P.

Left occipito-posterior—L. O. P.

Relative frequency: 70, 10, 17, and 3 per cent. respectively.

*Face Positions.*

Left mento-anterior—L. M. A.

Right mento-anterior—R. M. A.

Right mento-posterior—R. M. P.

Left mento-posterior—L. M. P.

*Breech Positions.*

Left sacro-anterior—L. S. A.

Right sacro-anterior—R. S. A.

Right sacro-posterior—R. S. P.

Left sacro-posterior—L. S. P.

*Transverse or Shoulder Positions.*

Left scapulo-anterior—L. Sc. A.

Left scapulo-posterior—L. Sc. P.

Right scapulo-posterior—R. Sc. P.

Right scapulo-anterior—R. Sc. A.

Note that in shoulder as in other presentations the terms right and left refer to the mother.

**Posture.**—By posture is meant the relation of the foetal members to one another. The usual foetal posture during pregnancy and parturition is one of flexion. As an element in the labor posture is most important as relates to the head.

## II. CLINICAL COURSE AND MECHANISM OF NORMAL LABOR.

**Normal labor**, as we shall define it, includes only labors in which all the mechanical factors are normal and which are otherwise uncomplicated—labors, in other words, having no element of dystocia. Only vertex births in anterior positions will be classed as normal.

### Stages of Labor.

*The first stage, or stage of dilatation*, ends with the complete dilatation or canalization of the utero-cervical zone.

*The second stage, or stage of expulsion*, ends at the birth of the child.



The *third, or placental stage*, includes the expulsion of the placenta, the complete evacuation and persistent retraction of the uterus.

### Causes of the Onset of Labor.

The causes which determine the advent of labor are not definitely known. Probable causes are: The loosening attachment of the ovum in the later weeks of gestation; distention of the uterus and the consequent reaction of the uterine muscles; development of the contractile power of the uterus; the growing vigor of the foetal movements; excess of carbon dioxide in the blood, acting upon the motor centers; increasing irritability of the uterus; the influence of the menstrual molimen. The separation of the decidua begins at the lower uterine segment with the first labor pains. The ovum thus becomes in part a foreign body. This furnishes sufficient stimulus for continued expulsive efforts.

### Phenomena of Beginning Labor.

Signs of the onset of labor are:

- Lightening;
- Irritability of the bladder and rectum;
- Increased flow of vaginal and cervical secretion;
- The show, a bloody discharge from the vagina;
- Expulsion of the cervical mucous plug;
- Rhythmic uterine pains.

By *lightening* is meant the sinking of the uterus, which takes place usually within from ten to fourteen days before labor actively begins. The uterus sinks more deeply in the pelvis. The waist-line becomes smaller. As the uterus settles lower in the pelvis the pressure on the bladder and

rectum is increased and these viscera are evacuated oftener than is the usual habit. Lightening, however, is not observed in all cases.

At the onset of active labor *urination* and *defecation* become still more frequent and there is a *profuse secretion* of vaginal and cervical mucus. The *vaginal discharge* may be stained with blood—the *show*. Usually the *mucous plug* which blocks the cervix during pregnancy is expelled as a tenacious, jelly-like mass.

The most reliable evidences of beginning labor are the occurrence of *rhythmic uterine pains* and contraction of the uterus with each pain as felt by the examining hand held upon the abdomen. The first pains are often little more than a sense of pressure, and are felt in the lumbosacral region. As labor advances they become more pronounced, extend in front to the lower abdominal region and radiate down the thighs.

**Labor Pains.**—Labor pains are the painful uterine contractions of labor. The painful character of the contractions is due to pressure on the nerve-filaments of the uterus and on the nerve-trunks in the pelvic cavity.

The *duration* of a pain is thirty to sixty seconds.

The usual *intervals* between the contractions at the beginning of labor are twenty to thirty minutes. They gradually shorten as labor goes on and may be reduced to a fraction of a minute at the acme of expulsion.

The intensity progressively increases, reaching its maximum at the expulsion of the head from the vaginal outlet.

### 1. First Stage: Stage of Dilatation.

**Dilatation.**—Three agencies are concerned in dilatation of the cervix:

1. Traction of the longitudinal muscular fibers of the upper uterine segment ;
2. Hydrostatic pressure of the bag of waters ;
3. Softening of the cervical structures by serous infiltration.

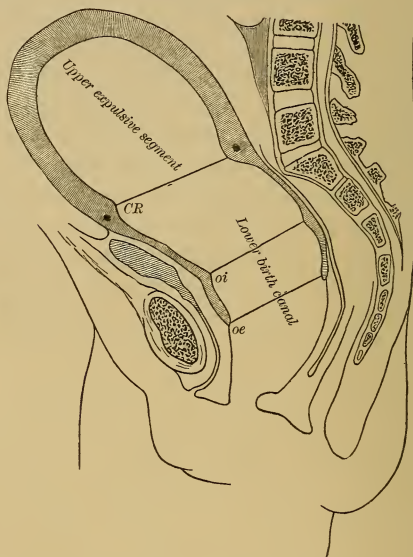
*Action of the Longitudinal Muscular Fibers.*—The traction of the upper segment of the uterus draws the lower segment upward over the presenting portion of the ovum. The dilatation begins at the os internum. With the first active labor pains the ovum is partially detached from the lower uterine segment. The internal os expands and the bag of waters protrudes into the cervical zone with each pain, receding in the intervals. At first the cervix, becoming somewhat funnel-shaped during the pains, nearly regains its cylindrical form in the intervals. As the labor advances the os internum is permanently effaced and the ovum rests against the os externum. From this time the progress of canalization is indicated by the size of the external os.

*The bag of waters* is the portion of the membranes which in the course of the labor protrudes downward into the cervix. It plays an important part in the mechanism of dilatation. Its contained liquor amnii, the fore-waters, is partly cut off from that above the head, the hind-waters, by the ball-valve action of the head as the latter is driven into the lower uterine segment during a pain. The general uterine pressure, however, is transmitted in some measure to the fore-waters. In accordance with the law of hydrostatics the bag of waters is not only urged downward, but it exerts a certain amount of expansive force upon the walls of the passive cervical zone.

When the membranes rupture prematurely the dilatation

of the cervix usually goes on more slowly and is more painful. The foetal head is not so good a dilator as the fluid wedge, the bag of membranes. It lacks the active dilating power and the equable pressure of the bag of

FIG. 34.



The uterus after complete canalization of the utero-cervical zone. CR. Contraction ring or retraction ring. oi. Os internum. oe. Os externum.

waters. The mechanical disadvantage is still greater in malpresentations and malpositions, by reason of the greater inequality of pressure on different parts of the resisting girdle.

In vertex presentation the bag of waters has a watch-glass shape.

The membranes rupture usually by the time they reach the pelvic floor, often sooner, or only on interference.

*Softening of the cervix*, established before labor, is much increased in course of the first stage. During a pain the walls of the uterus are everywhere compressed by contraction upon its contents, except at the cervix. The blood vessels of the cervix, unsupported by pressure, become engorged, and a serous transudation takes place into its tissues, loosening its structure.

**Retraction Ring.**—In course of the first stage of labor the upper uterine segment becomes thickened, retraction of the muscular structures into that segment taking place with each pain; the lower segment becomes correspondingly thinned. The line of demarcation between the thickened upper and the thinned lower segment is the contraction ring, or, as it may more properly be termed, the retraction ring. It is well defined only during a pain. The retraction ring generally can be felt above the brim by the close of the first stage, and it rises higher in proportion to the number and strength of the pains.

**Retraction of the Pubic Segment.**—The posterior wall of the bladder and the whole pubic segment of the pelvic floor begin to be drawn upward during the latter part of the stage of dilatation. The elevation is marked during the second stage. The bladder is thus lifted partly out of the lesser pelvis away from injurious pressure during the birth. Only a very small portion of the organ rises above the level of the pubic bones. The length of the urethra remains unchanged.

**The duration** of the first stage is from two or three hours to several days. The average length of this stage is, in primiparæ, eleven hours; in multiparæ, seven hours.

## 2. Second Stage: Stage of Expulsion.

**The Mechanism of the Second Stage of Labor.**—The most important mechanical phenomena of the second stage of labor are those pertaining to the series of passive movements which the foetus undergoes in course of its expulsion through the birth canal.

The engaging diameters of the head being larger than those of any other part of the foetal mass, the essential mechanical phenomena of the stage of expulsion are those pertaining to the birth of the head. To rightly comprehend them it must be borne in mind that the foetal head is an irregular ovoid body, which in typical labors tightly fits the birth canal; and that the shape and direction of the parturient tract change at every point throughout its length. The essential cause of the head movements is adaptation or accommodation of the head to the varying shape and course of the birth-canal. These movements are descent, flexion, rotation, extension; restitution and external rotation are additional movements impressed upon the head after its escape from the passages, in consequence of the spiral motion of the trunk in course of its descent as explained later.

**Descent.**—In the stage of expulsion the uterine contractions are reinforced by the action of the abdominal muscles. Hence the bearing-down character of the pains at this period. Before escape of the waters the expellant force is transmitted to the head through the entire uterine contents. After rupture of the membranes the propelling force acts directly upon the foetus. The foetal mass under the general uterine pressure moves in the direction of least resistance, through the birth-canal.

The head advances with the pains and recedes in the intervals, and in normal conditions this advance and recession continue till the head is well in the grasp of the vulvar ring.

**Flexion.**—A certain degree of flexion is present primarily. It belongs to the normal posture of the foetus in utero.

The primary flexion is increased as the descent begins, and for this reason: The head is so hinged upon the trunk that the occipito-frontal diameter corresponds to a lever of unequal arms, the frontal arm being the longer. On engagement in the utero-cervical zone, the resistance, though equal at the two ends of the lever, acts with greater effect on the longer or frontal arm, and the chin dips toward the sternum. Flexion is still more increased when the head encounters the greater resistance of the bony canal.

Another agency in flexion is the influence of the uterine contractions which tend to bring the long diameter of the cephalic ellipsoid into conformity with the long diameter of the uterus.

The advantage of flexion is apparent. It substitutes the suboccipito-bregmatic diameter, 9.5 cm.,  $3\frac{3}{4}$  inches, for the occipito-frontal, 11.5 cm.,  $4\frac{1}{2}$  inches, a gain quite enough in most cases to make all the difference between a possible and an impossible delivery. The head undergoes still further accommodation to the passages by moulding yet to be described.

**Rotation.**—At the brim the longest diameter of the pelvis which is available for the passage of the head is the oblique; at the outlet the longest is the antero-posterior. The head, therefore, as it descends must rotate



about the axis of the birth-canal to keep its longest engaging diameter constantly in the longest diameter of the pelvis during its passage through it.

Rotation of the head is due chiefly to the slope of the lateral halves of the pelvic floor downward, forward and inward. In normal labor the occipital pole first lands upon one lateral half of the floor, and as it descends it is thrust forward and inward beneath the pubic arch. A firm pelvic floor, together with efficient labor pains, is, therefore, essential to forward rotation of the occiput. Flexion, moulding of the head and the development of the caput succedaneum, yet to be described, promote rotation by increasing the dip of the occipital pole. After the occiput has sunk below the level of the pubic arch its forward rotation is due partly to the fact that this is the direction of least resistance. Complete rotation is seldom observed. The head is usually expelled in a position slightly oblique to the median antero-posterior plane of the parturient outlet.

**Extension.**—After the occiput has escaped beneath the pubic arch the nape of the neck rests against the subpubic ligament, and the head, rotating upon the nucha as a pivotal point, is born by a movement of extension, the vertex, the forehead and the face successively sweeping over the perineum. The chin, however, does not, as formerly assumed, leave the sternum till the moment of expulsion. A brief pause usually follows the birth of the head.

**Restitution.**—Since the shoulders descend in the oblique diameter opposite that in which the head engages, rotation of the head during its descent through the pelvis brings about a certain degree of torsion of the neck. After the

head is born the neck untwists and the head, if left to itself, takes a position corresponding to that in which it entered the pelvis. This movement is termed *restitution*. It may be utilized as a means of confirming the diagnosis of position.

**External rotation** is a still further rotation of the head which is observed during the expulsion of the body ; it occurs in consequence of the spiral movement of the trunk as it traverses the birth-canal.

**Birth of the Trunk.**—The shoulders and the breech rotate to some extent as they descend through the pelvis, but less perfectly than the head. The rotation takes place in a direction opposite to that of the head, since the shoulders and breech come down in the opposite oblique diameter of the pelvis. The anterior shoulder is expelled first, or it lodges behind the pubic bones and the posterior shoulder first appears at the ostium vaginae and escapes over the edge of the vulvar ring. A gush of bloody water generally accompanies the birth of the trunk.

**Other Phenomena : Caput Succedaneum.**—The caput succedaneum is an œdematous swelling developed upon the presenting part of the foetus after rupture of the membranes. In cephalic presentation it forms on the part of the head within the girdle of resistance. The vessels here, unsupported by pressure during the uterine contractions, become engorged and serous infiltration of the tissues ensues. The size of the tumor increases with the number and strength of the pains. Its location differs with the position in which the head has entered the pelvis. In L. O. A. positions it forms on the right, in R. O. A. upon the left, posterior parietal region. In R. O. P. positions it appears upon the left anterior, and in L. O. P.

upon the right anterior, parietal region. The location, however, may be modified when the head has rested long in the lower portion of the birth-canal after having undergone partial rotation.

**Moulding of the Head.**—Owing to the plasticity of the cranial vault the adaptation of head to pelvis is in part accomplished by moulding. Under pressure of the pelvic walls the engaging diameters of the cranial vault are reduced and the head is elongated in the direction of the passages.

**Perineal Stage.**—As the occiput approaches the outlet of the soft parts the sacral segment of the pelvic floor is stretched and pushed downward and forward in front of the advancing head. Its length from coccyx to posterior commissure is increased at the moment of expulsion to 13 cm., 5 or 6 inches. The sphincter ani is relaxed, the anal orifice gapes widely and feces are usually expelled from the rectum as the head passes over the pelvic floor. As the equator of the head escapes from the vulvo-vaginal orifice the posterior segment of the floor promptly retracts over the face.

**Pulse and Temperature.**—The maternal pulse-rate is somewhat accelerated during the pains. The maternal temperature, particularly in hard labor, is generally a degree or more above the normal at the termination of the birth.

The foetal pulse-rate is retarded at the height of the pains, owing to increased arterial tension in the foetus.

The length of the second stage in primiparæ is from one to seven hours — average about two hours; in multiparæ, fifteen minutes to two hours — average about one hour.

### 3. Third Stage: Placental Stage.

**Events.**—(1) Separation of the placenta; (2) expulsion of the placenta and blood-clots; (3) retraction of the uterus.

**Separation of the placenta** takes place in the meshy layer of the decidua; it is brought about partly by contraction of the placental site which goes on as the uterus retracts, and partly by the extruding force of the uterine contractions.

**Expulsion of the placenta** is effected by the extruding force of the uterine contractions. The after-birth may present by its amniotic surface or may be expelled edge first. Its expulsion from the vagina is explained by the tonicity of the muscular structures in the posterior segment of the pelvic floor. The placenta expelled through the rent in the membranes, through which the child has already escaped, drags the membranes after it, gradually peeling them from the uterine wall.

**Retraction of the uterus** consists in a thickening and shortening of its wall, due in part to rearrangement of the muscular fibers, in part to thickening and shortening of the fibers themselves. Normally retraction of the upper segment is promptly established at the close of labor. It securely ligates the uterine vessels which have been torn across by separation of the placenta. The lower segment remains passive for several hours after the close of labor.

**The duration** of the third stage varies from a few minutes to two hours. Its average length is from twenty to thirty minutes.

**The average length of normal labor** is, in primiparæ,

twelve hours ; in multiparæ, eight hours. Variations from two to twenty-four hours are not uncommon within normal limits.

### III. MANAGEMENT OF LABOR.

**Preparatory.**—The duties of the obstetrician to his patient, especially in the later months of pregnancy, are scarcely less important than those pertaining to the management of labor and the post-partum period. The enforcement of hygienic rules, attention to the general health, urinary examinations once weekly or oftener during the last two or three months and instructions with reference to the care of the nipples are essential to the proper conduct of the obstetric case. At this period, too, the physician acquaints himself in so far as possible with the conditions with which he will have to deal in the subsequent care of the patient. A month before the expected date of labor a systematic examination should be made according to the following plan :

#### **Ante-partum Examination.**

##### *Scheme.*

#### **History.**

- General health ;
- Character of previous pregnancies, labors, puerperiums, miscarriages ;
- Date of last menses and probable date of labor ;
- Important data concerning the present pregnancy ;
- Character of the vaginal discharge.

#### **Breasts.**

- Shape ;
- Development ;
- Nipples, development, malformations.

**Abdominal Examination.**

Pendulous abdomen ;  
Hydramnios ;  
Complicating tumors ;  
Twins ;  
Location of placenta ;<sup>1</sup>  
Presentation, position and posture of foetus ;  
Length of the foetal ovoid ;  
Size and hardness of the foetal head ;  
Foetal pulse-rate ;  
External measurements of the pelvis in primiparæ  
and in multiparæ with a history of difficult labors.

**Vaginal Examination.**

Former injuries—pudendal, vaginal, cervical ;  
Placenta prævia ;  
Obstructing tumors ;  
Measurements of the diagonal conjugate and other  
diameters of the pelvis in primiparæ and in mul-  
tiparæ whose history excites suspicion of pelvic  
contraction.

**Method of Abdominal Examination for Presentation and Position.**

1. **Preparation.**—The patient is placed in the horizontal posture (supine, with the lower limbs extended) with the abdomen fully exposed, or covered only with a sheet. When the sheet is used the examination may be conducted through this covering, or, better, with the hands underneath it. Before examining, the hands of the operator are

<sup>1</sup> When the round ligaments are far apart, converging downward, the placenta is on the anterior wall ; when they fall near together, converging upward, it is on the posterior wall of the uterus. For diagnosis of vicious implantation of placenta see Placenta Prævia.

bathed in warm water to render the sense of touch more acute, and because contact of cold hands might excite re-

FIG. 35.



Displacing foetus to one side of abdomen for locating dorsal plane.

flex contractions of the abdominal and uterine muscles which would interfere with the examination.



## 2. Locating the dorsal plane and small parts.

This is done by any one or all the following methods :

- a.* The entire surface of the abdomen is palpated systematically, using light touches with the palmar surfaces of the finger-tips.
- b.* Downward pressure is applied with one hand on the upper foetal pole in the direction of the foetal axis ; this steadies the dorsum and brings it nearer to the abdominal wall where it may more satisfactorily be palpated with the other hand. The child's back is identified by the length and breadth of the resisting plane. Distinguish from the lateral plane by the greater width of the dorsal, by the convexity of the latter and by the absence of a sulcus between it and the head.
- c.* Place the palmar surface of one hand flat on the median section of the abdomen at the umbilicus, and press backward toward the spinal column. The child will be displaced to the side toward which its back lies and the liquor amnii to the other. Palpating with the other hand, the solid is readily distinguished from the fluid tumor. (Fig. 35.)

Small parts are felt as nodules which glide freely about under the touch ; sometimes their outlines may be fully traced. Circular rubbing movements with the finger-tips help to identify them. The side on which they are felt is that opposite the foetal dorsum. In full anterior positions of the child's back the small parts may not be accessible to palpation. Small parts in the median section of the abdomen indicate a dorso-posterior position of the foetus.

## 3. Examining the Lower Foetal Pole.—With both hands

over the lower uterine segment just above Poupart's ligaments, finger-tips toward the mother's feet, and palmar

FIG. 36.



Examining lower foetal pole.

surfaces nearly facing each other, the lower foetal pole is caught between the hands. (Fig. 36.) In difficult cases

the following manipulation helps to find the head : bringing the hands gradually nearer and nearer together, while

FIG. 37.



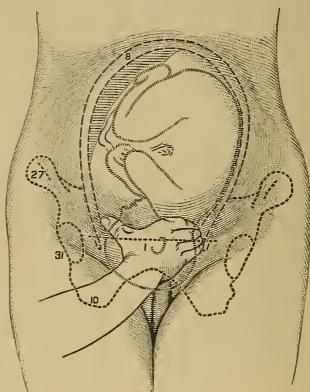
Grasping foetal head with hand over abdomen for locating cephalic prominence.

placed as above described, move them as if to toss the head sharply from one hand to the other.

The head feels hard and globular; there is a lateral sulcus between it and the trunk; in primiparæ (not in multiparæ) it is in the pelvic excavation before labor.

The breech alone is smaller, with all its component elements it is larger, than the head; it lacks the hard and globular feel of the head, presents no sulcus, and it is never in the excavation before labor. If small parts can

FIG. 38.



Locating cephalic prominence by grasping the head with one hand over the abdomen. (LEOPOLD AND SAENGER.)

be felt just beyond either foetal pole that pole is almost surely the breech.

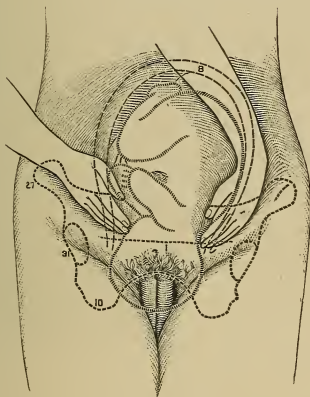
The head in either iliac fossa indicates a cross-birth.

After lightening the head may be found in the excavation even in multiparæ in one-third the cases, before labor.

**Cephalic Prominence.**—When the head is in the brim

the cephalic prominence is greater on the side of the *sin-ciput*. The location of the cephalic prominence affords some aid in deciding whether the child's back lies to the right or the left. It is located by grasping the head with one hand held transversely across the suprapubic region (Figs. 37, 38), or by palpation with both hands (Fig. 39).

FIG. 39.



Locating cephalic prominence by palpation with both hands. (LEOPOLD AND SAENGER.)

The hand sinks more deeply in the excavation on the side opposite the prominence.

**4. Examining the Upper Fœtal Pole.**—With both hands over the upper uterine segment, finger-tips toward the mother's face (Fig. 40) and palmar surfaces nearly facing each other, the fœtal poles are differentiated by the signs already given and by ballottement of the head. The

breech lacks the flexible attachment to the trunk which characterizes the head, and it has less mobility by reason of this and of its greater bulk when taken with all its com-

FIG. 40.



Examining upper foetal pole.

ponent parts. Ballottement of the head when in the lower uterine segment is possible only with excess of liquor amnii.

5. **Locating the Anterior Shoulder.**—The hands are placed over the sides of the head and, with firm pressure,

FIG. 41.



Locating anterior shoulder.

moved toward the breech; the first obstacle they encounter is the anterior shoulder. Usually it can be identified by its anatomical characters (Fig. 41).



Location of the anterior shoulder within one or two inches of the median line indicates an anterior position of the child's back; anterior shoulder several inches away from the median line indicates a posterior position of the back.

**6. Locating the Fœtal Heart.**—The place at which the fœtal heart-tones are heard loudest is called the focus of auscultation. It is usually an area of about 7.5 cm., 3 inches, in diameter. As a rule it lies nearly over the lower angle of the left scapula of the fœtus, or at least the upper part of the fœtal dorsum. Heart-sounds in the upper uterine segment indicate a breech, in the lower a cephalic presentation. The heart, however, is situated nearly midway between the ends of the fœtal ellipse. In multiparæ, therefore, in whom neither pole sinks into the lesser pelvis before labor begins, the location of the fœtal heart-tones is of little value for the diagnosis of presentation.

Occasionally the focus of auscultation does not immediately overlie the heart. It may be found at some remote point owing to firmer contact of the fœtus with the uterine wall at that point.

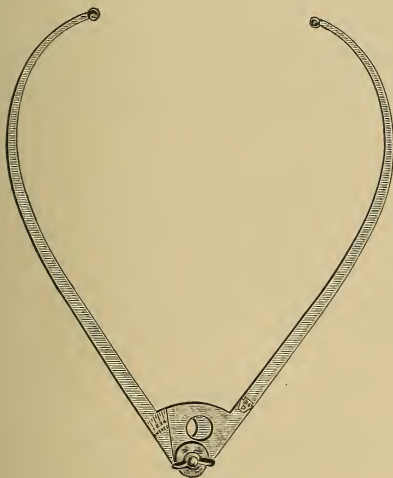
The location of the fœtal heart is especially useful in distinguishing between right and left and between anterior and posterior positions of the child's back. Heart-tones to the left indicate a left, to the right a right, position; heart-tones near the median line indicate an anterior, far from it a posterior position.

**External Pelvimetry.**—Measurement of the external diameters requires the use of a suitable instrument. A good portable pelvimeter for external measurements is Schultze's or Collyer's. (Fig. 42.)

Marked asymmetry of the pelvis is sometimes apparent on external palpation.

Interspinal and intercrystal diameters both small indicates general pelvic contraction. Interspinal equal to or greater than the intercrystal indicates antero-posterior flattening. For the external conjugate 7 inches may be taken

FIG. 42.



Collyer's pelvimeter.

as the average lower limit in normal pelvises. Yet variations of  $\frac{1}{2}$  to 1 inch above or below this limit are observed.

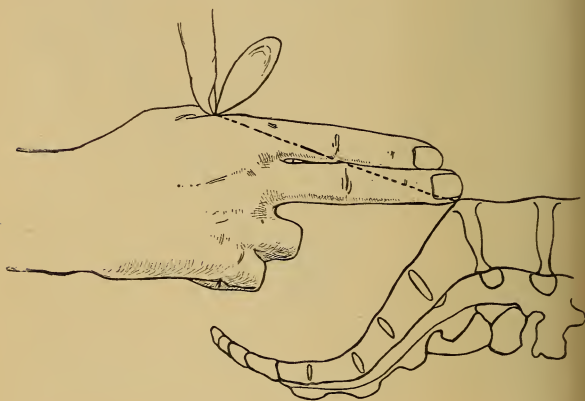
When the external conjugate is below  $6\frac{1}{4}$  inches the pelvis is surely contracted ; when above 8 inches the pelvis is almost surely ample ; within these limits, the question is in doubt, pending the internal examination.

### Method of Vaginal Examination and Internal Pelvimetry.

The bladder and the rectum must be empty. Antiseptic precautions are to be observed as in examinations during labor. Measure the depth of the symphysis pubis, width of the subpubic angle, the bisischial, the sacropubic and the diagonal conjugate diameters, and note the size and shape of the sacrum.

The transverse diameter at the outlet may be measured externally by taking the distance between the inner aspects of the ischial tuberosities measured on a line drawn

FIG. 43.



Measuring the diagonal conjugate.

through the anterior margin of the anus. It may be measured internally with the aid of a suitable instrument, or approximately by the hand.

The antero-posterior diameter at the inferior strait is obtained in a manner similar to that described below for the diagonal conjugate. It may more readily be measured externally with a pelvimeter.

The **diagonal conjugate** is measured as follows: Passing the index and second finger into the vagina, the tip of the second is placed against the summit of the promontory, the radial edge of the hand resting against the subpubic ligament. The latter point of contact is marked with the index finger of the other hand. Withdrawing the hand the distance between the two points of contact is measured. This distance is the diagonal conjugate. (Fig. 43.)

The **true conjugate** is found by deducting 1.3 to 2 cm.,  $\frac{1}{2}$  to  $\frac{3}{4}$  inch, according to the depth and inclination of the symphysis pubis, from the diagonal—one-half inch when the symphysis measures less, three-fourths inch when the symphysis measures more, than 4.5 cm.,  $1\frac{3}{4}$  inch.

The other diameters are estimated by palpating the walls of the cavity.

### General Preparations for Labor.

**Obstetric Armamentarium.**—For general practice the obstetric bag should be equipped with obstetric forceps, a pelvimeter, a soft-rubber catheter, a hypodermic syringe, a fountain syringe, a uterine douche-tube of glass, needles, needle-forceps, aseptic sutures, hand brushes, a Sims' speculum, a sponge-holding forceps, a volsella, a curette and a yard of aseptic gauze.

It should also contain four ounces of Squibb's chloroform, an ounce of Squibb's ergot, a few drachms of chloral, morphine tablets, gr.  $\frac{1}{8}$ , fluid extract of veratrum

viride and antiseptic tablets of the biniodide or bichloride of mercury, or either of the following powders :

R.—Hydrargyri biniodidi,  
Potassii iodidi, āā ʒj.—M.

Chart. no. viii.

S. One to a quart of warm water, as an antiseptic solution.

R.—Hydrargyri bichloridi,  
Acidi tartarici, āā ʒj.—M.

Chart. no. viii.

S. One to a quart of warm water, as an antiseptic solution.

*The nurse should have ready* a half dozen clean sheets, a dozen recently laundered towels, a dozen pieces of cheese-cloth, 45 cm., 18 inches, square, for wash-cloths ; two or three pieces of unbleached muslin for binders, a little over a meter long by 50 cm. wide,  $1\frac{1}{4}$  by  $\frac{1}{2}$  yard ; two surgically clean rubber sheets wide enough to reach across the bed (table oilcloth may serve when economy requires) ; scissors, two dozen shield-pins of medium size ; a bed-pan of earthenware or of agate ironware, two or three clean hand-basins of like material, a slop-jar, one or more new hand-brushes, plenty of hot and of cold water, a yard of strong linen bobbin, one-sixteenth of an inch in width, for tying the navel cord ; a woollen blanket to wrap the child in, an infant's bath-tub and a bath-thermometer, Castile soap, an ounce package of aseptic cotton for the navel dressing ; the child's clothing.

Hand-brushes, scissors, cheese-cloths and the ligature for the funis should be wrapped in a towel and sterilized by steam or by boiling at the beginning of labor in a  $1\frac{1}{2}$ -percent. solution of sodium carbonate. They are kept enveloped in the towel until wanted for use. Similar care should be taken with all other appliances that otherwise

might directly or indirectly be the source of infection to mother or child.

**The Lying-in Room.**—The lying-in room should be a large, well-ventilated room, with sanitary plumbing, or none at all, preferably with a southern exposure. The room, the bedding and the clothing of the patient must be absolutely clean.

**Preparation of the Bed.** *Directions for the Nurse.*—The mattress should be covered with a muslin sheet, and that with a rubber sheet large enough to reach across the bed. A clean muslin sheet is spread over the rubber and pinned fast to the mattress. Over that is spread a second rubber covered with a muslin sheet. Two or three fresh laundered sheets, twice folded, are placed in position to receive and absorb the discharges. The rubber and the muslin sheets must be surgically clean. Table oilcloth may be substituted for rubber when economy requires.

*Labor Pad.*—In place of the folded sheets an aseptic pad of cotton batting, cotton-waste, paper-wool or other absorbent material, covered with cheese-cloth, may be used to receive the discharges. It should be three feet square. A large Kelly rubber pad may be substituted for the absorbent pad.

### Antisepsis.

#### *Antiseptic Agents.*

1. **Dry heat** at  $284^{\circ}$  F.—Exposure in an oven for half an hour may serve for utensils.
2. **Boiling** for ten minutes, or **steaming** for half an hour. Boiling is best done in water to which  $1\frac{1}{2}$  per cent. of sodium carbonate, c. p. (washing soda), has been added. The soda removes greasy matter and tends to prevent

metallic instruments from rusting, and boiling in the solution is a much more efficient germicide than boiling in plain water.

### 3. Chemical Antiseptics.

*Mercuric iodide solution, 1 : 2000.*

R.—Hydrargyri biniodidi	}	. . . . .	āā gr. vijss.
Potassii iodidi			
Aquæ <sup>1</sup>		. . . . .	Oij.—M.

*Mercuric chloride (sublimate) solution, 1 : 2000.*

R.—Hydrargyri bichloridi	. . . . .	gr. vijss.
Acidi tartarici	. . . . .	gr. xl.
Aquæ	. . . . .	Oij.—M.

*Chlorinated soda solution, 1 : 10.*

R.—Liquor sodæ chloratæ	. . . . .	℥j.
Aquæ	. . . . .	℥ix.—M.

*Creolin solution, 1 : 100.<sup>2</sup>*

R.—Creolin	. . . . .	℥ijss.
Aquæ	. . . . .	Oij.—M.

*Carbolic solution, 1 : 20.<sup>2</sup>*

R.—Acidi carbolic	}	. . . . .	āā ℥jss.
Glycerini			
Aquæ		. . . . .	Oij.—M.

Peroxide of hydrogen in full strength, or diluted with one, two or four volumes of water, is a useful antiseptic. It has the advantage of being non-poisonous.

### *Practical Rules for Antisepsis.*

**Non-metallic utensils** may be disinfected with any of the foregoing agents ; heat is the most efficient.

**Metallic instruments** are best sterilized by boiling in the 1½-per-cent. soda solution. They may for convenience in handling first be wrapped in a towel.

<sup>1</sup> Best, boiled water.

<sup>2</sup> Approximately.



Cloths, bed-linen, etc., are best sterilized by steaming. Flowing steam is most active. Dry heat does not penetrate dressings well.

When the chemical solutions are used exposure for at least a half hour is desirable.

The obstetrician should wear a sterilized operating-gown to cover his clothing and prevent contact of his hands and arms therewith.

### *Technique of Hand-cleaning.*

#### *(a) Fürbringer Method.*

1. The nails are kept short and cleaned dry.
2. The hands and forearms are scrubbed thoroughly with soap and hot water and a hand-brush for not less than five or ten minutes, giving special attention to the fingertips and the free edges of the nails, using two or three changes of water and finishing in running water.
3. The soap is thoroughly removed with sterilized water.
4. The hands and forearms are held in the mercurial solution (1 : 2000) for five minutes.

As an additional precaution the hands may be wet well with alcohol (80 per cent.) before immersion in the antiseptic solution. This helps to remove fatty matter and by dehydrating the skin makes the antiseptic sink more deeply.

Hand-brushes should be steamed for ten minutes or boiled in the soda solution for the same length of time.

#### *(b) Permanganate Method.*

Steps 1, 2 and 3 as in (a).

4. Immerse for two or three minutes in a warm saturated solution of permanganate of potassium in hot water.

5. Remove the permanganate stain by immersing in a warm saturated solution of oxalic acid made with sterilized water.

6. Rinse with sterilized water.

7. Immerse for five minutes in a mercuric chloride solution, 1 : 500.

With this method the hands may be rendered sterile to culture-tests.

(c) *Chlorinated Soda Method.*

Steps 1, 2 and 3 as in (a).

Cover the skin with a paste made by wetting with boiled water a handful of fresh chlorinated lime. Rub the paste over the hands with a crystal of washing soda till it feels cold. Scrub well for five minutes with a sterilized brush. Rinse with sterilized water, then with alcohol, and finally with the water again. This, too, yields sterile results.

(d) *Boiled Gloves.*

Prepare the hands as in (a).

Then put on thin rubber or lisle thread gloves which have been boiled for ten minutes.

The gloves are especially useful when the hands are sore or have been recently exposed to virulent infection.

After cleansing, to prevent reinfection of the hands, they must touch nothing that is not aseptic. They should be held for a moment in the mercurial solution before each internal examination.

It should be remembered that the skin though superficially sterilized does not remain so for many minutes, since germs lodged in the sebaceous glands and hair follicles soon find their way to the surface.

**Lubricants.**—As a lubricant for the hands, either a

1:500 solution of mercuric iodide in glycerin may be used, or they may be wet with the antiseptic solution. Keeping the hands smeared with the biniodized glycerin keeps the skin soft and maintains continuous disinfection. Glycerin recently sterilized by heating to 212° F. for ten minutes may be used instead of biniodized glycerin as a lubricant.

**The nurse** should wear wash dresses recently laundered, and should prepare her hands, as the doctor does, before contact with the genitals of the obstetric patient.

**The patient**, at the onset of labor, is given a bath and a change of clothing. Before the internal examination the nurse cleanses the external genitals, the thighs, and abdomen of the patient with soap and warm water for five minutes; the soapy water is then removed and the parts gently scrubbed for five minutes with the antiseptic solution.

In case of yellowish, greenish or foetid discharges the vagina and cervical canal should be prepared in like manner, cleansing with soap and water, using gentle friction, and finally with an antiseptic douche continued for at least five minutes, with friction. The object is prophylaxis, not alone against infection of maternal wounds but of the child as well, especially its eyes.

The antiseptic may be the chlorinated soda or the creolin solution. Mercurial irrigation if used at all should be followed after five or ten minutes with a plain sterilized water douche to wash out the chemical as a precaution against mercurial intoxication. A more satisfactory disinfection is effected by douching twice daily for a week or two before labor, when possible, with a mercurial solution or with a 2-per-cent. lactic-acid solution.

It is well for the nurse, after carefully cleansing the external genitals at the onset of labor, to apply a compress kept wet with Thiersch's solution, or a saturated boric-acid solution, to be worn during the first and the second stage.

### **Examination of Patient During Labor.**

#### *Scheme.*

#### **1. Verbal.**

##### *Precursory signs of labor :*

Lightening ;

Frequency of urination and bowel movements.

##### *Signs of actual labor :*

Increased frequency of urination and defecation ;

Bloody discharge—the show ;

Expulsion of mucous plug from the cervix ;

Rhythmic pains, first felt in the lumbo-sacral then in the lower abdominal regions.

#### **2. Abdominal.**

Pendulous abdomen ;

Hydramnios ;

Pathological growths ;

One fœtus or two ;

Location of placenta ;

Presentation, position and posture of the fœtus ;

Fœtal heart-tones, rate, rhythm, force ;

Bladder, empty or not ;

Hardness of the head ;

Relative size of head and pelvis.

#### **3. Pelvic.**

Pudendum, rigidity, œdema, former injuries ;

Vagina, mucosa healthy or not ; secretion normal or not ; former injuries ;  
Rectum and bladder, full or empty ;  
Bony pelvis : diagonal conjugate and other diameters ; shape, inclination ;  
Cervix, how much dilated ; dilatable ; former injuries ;  
Bag of waters, size, shape, ruptured or not ;  
Presentation, position and posture of fœtus ;  
Caput succedaneum, how large ;  
Stage of progress.

In the internal examination *vertex presentation* is recognized by the hard and globular character of the head, and by tracing the sutures and fontanelles ; the *position* is made out by locating the sagittal suture and finding which end is forward ; the *posture* by noting the relative descent of the fontanelles ; the *stage of progress*, in the first stage by the extent of cervical expansion, in the second by the situation of the leading pole, occiput, as relating to the landmarks of the birth-canal.

Examine deliberately all accessible fœtal parts with a firm touch. Examination is best begun during a pain and continued into the interval. The frequency and strength of the pains and the general condition of the patient, including her pulse and temperature, should be observed.

The *prognosis* usually must be guarded ; it should be made as definite as the findings permit. All else being normal the duration of labor will depend on the strength and frequency of the uterine contractions and the ability of the patient to help them by voluntary effort.

### Management of the Stage of Dilatation.

*Measures for the relief of severe pain* are chloral, in doses of gr. xv in water, every fifteen minutes till three are given, opium, gr. j, or an equivalent dose of morphine or codeine. Yet opiates should seldom be given and only in the event of great pain and restlessness.

Chloroform, by inhalation, is very rarely permissible in the latter part of the first stage. The use of chloroform at this time is almost certain to impair the efficiency of the pains. Once begun it cannot easily be discontinued till the expulsion of the child, and prolonged chloroform inhalation is a dangerous depressant. General anæsthesia should be withheld, therefore, until absolutely required.

**Vaginal examinations** should be as infrequent as is consistent with a proper knowledge of the case. If a careful ante-partum examination has been made a single internal examination will usually be sufficient for the first stage of labor. Nothing so surely protects the parturient against infection as the avoidance of all internal interference. It is frequently possible to conduct the labor to its termination with no vaginal examination at all.

**Special Directions.**—Active measures for accelerating the first stage are permissible only when indicated by danger to mother or child.

It is a general rule to remain with the patient, or at least, in the house, from the time the os externum has reached the size of a silver dollar.

The patient must be advised not to keep the bed, not to bear down with the pains and to empty the bladder and the rectum frequently. The lower bowel should always

be cleared once or more at the onset of labor with an enema of warm water. Instructions should be given with reference to diet.

The maternal and the foetal pulse-rate are to be noted from time to time. A foetal pulse below 110 or above 160 to the minute should be regarded as a signal of danger to the child.

#### **Management of the Stage of Expulsion.**

**Taking the Bed.**—The patient should take the bed when the second stage begins, sooner if the pains are severe or the membranes have ruptured.

She should be dressed for the bed with her night clothing turned up and pinned at the shoulders, and with a clean folded sheet fastened about the waist like a skirt. The sheet serves the purpose of protecting the patient's clothing and the upper part of the body from soiling with the genital discharges. These precautions simplify the duties of the nurse in cleansing the patient at the close of labor.

**Rupture of the Membranes.**—The bag of membranes, if still unbroken, should be ruptured artificially when it reaches the pelvic floor. It may be torn with the fingernail or punctured with a stout hairpin, previously flamed, or with a sharp-pointed scissors. The instrument is passed with its point resting on the finger as a guard and the bag punctured while tense, during a pain.

**Puller.**—Unless the labor is over-rapid, the patient may be permitted, during the pains, to pull upon the sheet twisted into a rope and fastened at one end to the foot of the bed. The use of the puller increases the efficiency of the voluntary expulsive efforts.



**Obstetric Position.**—Generally the position may be left to the patient. For internal examinations the dorsal recumbent position is best. At the perineal stage the position most favorable from the standpoint of both the mechanism and the management is the lateral. Occasional changes of posture relieve fatigue and promote the progress of labor.

**Vaginal Examinations** should be infrequent. It will seldom be necessary to examine internally oftener than once an hour at the most. A single examination at the beginning of the second stage usually is sufficient. This is generally desirable to make sure that the cord or a hand has not prolapsed and that no other irregularity is present. Once assured that all is normal, further interference within the passages is not only unnecessary but is injurious. The progress of labor while the head is passing the brim may be observed by palpation over the lower abdomen. After the head has sunk well into the lesser pelvis the rate of descent may be watched by examining through the pelvic floor, with the finger on the skin surface near the posterior vulvar commissure; by deep pressure at this point the head can be felt before it rests on the floor. By these means internal manipulations may be reduced to a minimum, and sometimes they may be wholly omitted.

**Anæsthesia.**—An anæsthetic, if properly administered, may be used with advantage in most labors during at least the latter part of the second stage. In obstetric anæsthesia the aim is to blunt the pain, not to abolish it. Here the anæsthetic is given for short periods and intermittently—with the pains only. At the moment of expulsion it may usually be carried nearly or quite to the

surgical degree. As a rule chloroform is preferred for

FIG. 44.



Giving chloroform with the towel inhaler and dropping-bottle.

mere obstetric analgesia. Ether should be chosen when complete anæsthesia is required for obstetric operations.

Ether is equally applicable for partial anæsthesia in simple labor and by some obstetricians is preferred, but it is not so pleasant.

The excessive use of anæsthetics, especially chloroform, while it is very seldom the direct cause of death in labor, is not infrequently a contributing factor.

It is generally a good rule to withhold anæsthetics as long as the pains are well borne without them. The prolonged and too free use of chloroform during labor is capable of serious injury to the mother. It must not be forgotten that the strength of the uterine contractions is impaired by anæsthetics.

*Method.*—Have the head low and the clothing loose, remove false teeth, examine the heart and protect the skin about the mouth and nose by smearing with vaselin or glycerin. A good inhaler is a towel spread over the head and lifted at its middle six or seven inches from the face. Ask the patient to breath rapidly when the pain begins. Drop on the towel opposite the mouth and nose one or two drops of chloroform at each breath. If ether is used, three or four drops at each respiration will be required. (Fig. 44.)

Whatever effect is to be produced must be obtained before the pain reaches its height. Normally at the acme of the uterine contraction the abdominal muscles are fixed and respiration is temporarily suspended.

**Regulation of the Expelling Forces.**—If the pains are feeble they may be stimulated by simple means, such, for example, as postural measures. Summon the aid of the abdominal muscles. In over-rapid labor the pains may be moderated by the use of anæsthetics and by regulating the action of the voluntary muscles. Anæsthetics arrest

or retard expulsion according to the freedom of dosage. Unnecessary manipulation of the cervix must be avoided; irritating the tissues lowers the resisting power and invites sepsis.

**Prevention of Pelvic-floor Lacerations.**—The chief reliance for preventing pelvic-floor injuries during the birth is a slow and gradual delivery of the head by its smallest diameters. Expulsion is to be retarded by anæsthesia and by the fingers held against the occiput. This permits the resisting structures to stretch. Not only the rate but the mechanism of expulsion must be regulated. Keeping the smallest circumference of the head in the grasp of the resisting girdle, press the head well up against the pubic arch as the forehead is about to escape. These measures reduce the strain on the soft parts. From the time the pelvic floor begins to bulge the birth of the head should rarely occupy less than a half hour.

Shelling out the head between the pains, manipulations within the rectum and most similar measures that have been recommended for the prevention of so-called perineal ruptures, must be regarded as useless if not injurious. Supporting the pelvic floor by pressure with the hand is rational in so far as it crowds the head into the subpubic arch and thus relieves the tension of the facial structures of the floor.

**Episiotomy.**—When much laceration is otherwise inevitable incise the resisting ring at the introitus bilaterally. Cut while the ring is tense during a pain. Pass a straight, narrow, blunt-pointed bistoury flatwise between the head and the cord-like girdle. Turn the cutting edge outward and cut horizontally, holding the knife parallel with the axis of the patient's body. The location of the

cut should be one-third way from the median line posteriorly when the parts are fully stretched. The length

FIG. 45.



Author's method of regulating the birth of the fetal head.

of the incision should be about 1 inch, the depth  $\frac{1}{4}$  inch. The incisions are sutured after labor.

**Management of the Cord.**—If coiled about the neck, slip the coils one by one over the head. Failing this, which is scarcely possible, cut the cord and deliver the trunk promptly.

**Delivery of the Trunk.**—Hold the head well up toward the mother's abdomen and deliver the posterior shoulder by hooking a finger in the axilla and lifting the shoulder over the posterior commissure. Disengage the posterior arm and then release the anterior shoulder. Extract the trunk slowly or leave its expulsion to nature. Powerful traction on the head should be avoided if possible, owing to the danger of inducing Duchenne's paralysis by stretching the nerve-trunks of the brachial plexus.

**Ligation of the Cord.**—As a rule, wait till notable pulsation ceases or until the child cries lustily. By delaying the ligation of the cord for several minutes, till respiration is established, a gain of from one to three ounces of blood is effected, a matter of importance more especially in premature and in puny or anæmic children. This post-natal afflux of blood is probably brought about by the force of thoracic aspiration in the child.

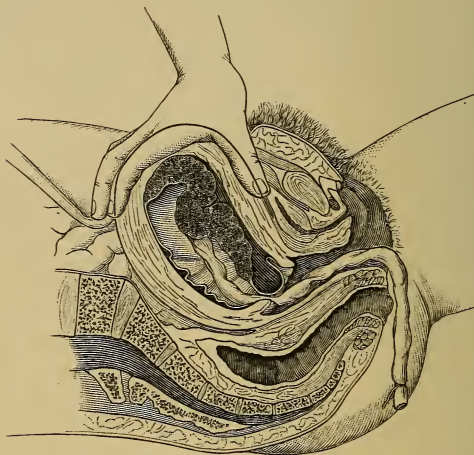
Tie the cord firmly with aseptic narrow linen bobbin 2.5 cm., about one inch, from the umbilicus. A second ligation to control the placental end of the cord is required in case of twins, since otherwise, if the placental circulations communicate the second child may be lost by hemorrhage; in single births it is not necessary. Cut with surgically clean scissors 6 mm., about  $\frac{1}{4}$  inch, outside the ligature. Press the end of the stump with a sterile cheese-cloth to see if it bleeds; if it does tie again. A thick cord should be pinched firmly before tying to press out the jelly of Wharton from the part to be ligated.



### Management of the Placental Stage.

From the moment the head is born the hand should be held on the abdomen over the uterus till evacuation and retraction of the uterus are complete. Gentle friction may be used if required to promote normal contractions.

FIG. 46.



Expressing the placenta by the method of Credé.

**Delivery of the Placenta. Credé's Method.**—When the placenta is not spontaneously expelled within thirty minutes after the birth of the child the uterine contractions are to be reinforced by the method of Credé. At the acme of the pain, not sooner, grasping the fundus through the abdominal wall with the thumb in front and fingers behind,



compress the fundus firmly. (Fig. 46.) To the compression should be added a moderate downward pressure in the uterine axis. To bring the uterine into line with the vaginal axis carry the fundus well back during the manipulation. Repeat the process with each pain till the placenta is expelled. The cord should not be pulled upon to assist delivery till the placenta is in the vagina or in the lower uterine segment.

If the first attempt fails ask the patient to strain forcibly during the next manipulation. Almost invariably the placenta will be expelled promptly.

**Manual Extraction.**—External measures failing after an hour, the placenta may be removed manually by seizing its lower edge with the fingers passed through the cervix.

**Management of the Membranes.**—On expulsion of the afterbirth pull very gently on the membranes till they are wholly detached. Should the uterus be contracted, wait till it relaxes lest a portion of the membranes still held in the grasp of the uterus be torn off and left behind.

**Examination of the Placenta and Membranes.**—The placenta and the membranes should be inspected carefully to make sure no fragments have been left in the passages. The membranes are best examined by transmitted light to see that both amnion and chorion are complete. When viewed in this manner a single membrane is quite translucent, both together somewhat opaque. Fragments of membrane wholly or partly in the vagina should be removed. When wholly in the uterus they are better left to be expelled with the lochial discharge. Manipulation within the passages, especially within the uterus, at the close of labor, exposes to infection.

### Laceration of the Passages.

**Cervical lacerations** should be closed immediately by suture in case they give rise to troublesome hemorrhage. Otherwise immediate suture is generally inadvisable. Spontaneous union takes place, as a rule, in aseptic convalescence.

*Method of Suture.*—No anæsthetic is needed. The patient is placed in the dorsal recumbent or lithotomy position on the bed or a table. The cervix is drawn well down with a volsella. The traction usually controls the hemorrhage for the time. The surfaces of the cervical wound are brought together and sutured with No. 2 plain or chromated catgut, the first stitch being passed above the angle of the tear. The sutures should be placed 2 cm., about  $\frac{3}{4}$  inch, apart.

**Lacerations of the Pelvic Floor.**—The frequency of pelvic-floor lacerations is in primiparæ from 15 to 35 per cent., in multiparæ about 10 per cent.

*Causes are:* Narrow pubic arch; a relatively small vulvo-vaginal orifice; rigidity of the pelvic floor, advanced age in primiparæ—over thirty years; faulty mechanism; too rapid delivery; unskilled use of forceps.

*Character of the Injury.*—Lacerations of the pelvic floor may be *complete* or *incomplete*.

Incomplete lacerations may be *external*, *internal* or *combined external and internal* tears.

In all except external lacerations the tear runs up into the vagina on one or both sides of the rectum, *i. e.*, in one or both vaginal sulci. When the laceration is confined to one side it takes a nearly straight course, terminating below in the perineum and above in the vaginal sulcus. When

the injury extends into both vaginal sulci the tear presents a Y shape.

*Degrees of Laceration.*—(1) External, not involving the muscles; (2) to the sphincter ani; (3) into the rectum.

*Treatment.* (a) *Time for Repair.*—Lacerations at the vaginal orifice involving the muscular or the fascial structures, should, as a rule, be sutured at the close of labor. Union, however, may be obtained by suturing at any time within a week or more if the wound is aseptic. Suturing while waiting for the delivery of the placenta may save the necessity for renewed anæsthesia; it is not advisable in extensive or complicated tears.

(b) *Suture Material.*—For surface work silkworm-gut, for buried sutures No. 2 plain or chromated sterilized catgut is used.

Catgut may be prepared by Fowler's method, boiling for an hour in absolute alcohol. Heating in cumol at a temperature just below 300° F. is the only method that ensures absolute sterilization. Sterile catgut put up in absolute alcohol in sealed glass tubes is secure against infection. Silkworm-gut is boiled in water or salt solution for ten minutes immediately before using.

(c) *Needle.*—A slightly curved Hagedorn or other surgical needle, about two inches long, is suitable. Lange or Martin needles will be found satisfactory. Small and medium sizes are required. A common darning-needle will do in the absence of a better. It may be held in the fingers or in a needle-holder.

(d) *Anæsthesia* is generally required. Chloroform is usually safe for the purpose if managed properly. Ether should be preferred.

Slight tears may sometimes be sutured with the aid of cocain anæsthesia. The cocain solution should be boiled immediately before using. It is most effective when injected at several points into the lips of the wound. Not more than a grain can safely be used in this manner.

(e) *Operation*.—The patient is placed in the lithotomy position with the hips at the edge of the bed or table. The knees may be held by assistants, or with a Kelly or Robb leg holder or with a Dickinson's sheet sling, as follows: Holding a sheet by diagonally opposite corners twist it loosely into a rope; with the patient in the required position pass the sheet sling under both knees, carry one end over one shoulder, across the back of the neck and over the other shoulder or under the arm to the front again; pull taut and tie the ends together in front of the chest.

Pack the vagina above the wound with sterilized strip gauze, to prevent the flow of blood over the field of operation. Remember to remove the packing after placing the sutures. Press the wound surfaces with a sponge compress repeatedly till dry. Make out fully the character and extent of the injury.

The aim should be to restore accurately the normal relations of the parts. Generally this may be promoted by catching the posterior vaginal wall with a volsella at what before rupture was the center of its lower end, and lifting this point nearly to the meatus urethræ, at the same time retracting the labia. The trough-shaped wound on one or both sides of the vagina will thus be plainly displayed. The vaginal wall is held in the position described till the sutures are laid. The plane of each suture should be nearly parallel with the skin surface of

the perineum, the deeper portion of the loop being nearest the skin. When the lacerations in the sulci are closed the remaining wound in the skin surface will be insignificant.

FIG. 47.



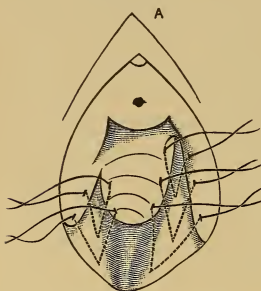
Tear running up one sulcus ; sutures in sulcus tied ; crown stitch in place.

cant. It may be brought together with a single crown (Fig. 47) or with two or three interrupted sutures.

The stitches in the sulci should be placed at intervals of  $\frac{1}{2}$  inch, beginning at the upper or vaginal angle of the wound. Enter the needle close to the edge of the wound, give it a fairly deep lateral sweep through one lip, emerging just short of the bottom of the wound, and pass it in reverse direction through the other lip. Care will be needed to avoid passing the needle into the rectum. The loop after the suture is tied should be nearly circular.

As the sutures are laid the opposite ends of each are knotted together or held with catch-forceps till they are ready to tie. When the sutures are placed they are tied tightly enough barely to coapt, not to constrict, the wound surfaces, first removing the gauze packing and clearing the wound of blood clots. If silkworm-gut is used the ends are left long to facilitate removal. (Figs. 48, 49, 50, 51.)

FIG. 48.



\*

Tear running up both sulci ; sutures laid in both.

FIG 49.



✱

One sulcus closed.

Lacerations entering the rectum may be sutured on three sides—the rectal, the vaginal and the perineal or skin side (Fig. 52), or the rectal suture may be omitted and the rectal mucous membrane be closed with buried catgut. (These are not shown in the figures.)

When the external sphincter is completely severed one or both muscle ends may be retracted within the tissues or may stand out plainly projecting above the wound surface. Draw out the ends if necessary with a tenaculum ; pass two

or three No. 1 plain catgut sutures through each end, carry them across and pass them through the opposite end.

The internal sphincter should be closed with a figure of eight suture passed close to the rectal mucous membrane and parallel with it.

To relieve the buried sphincter sutures of too great strain they should be reinforced with one or two silkworm-gut sutures as follows : Enter the needle from the skin sur-

FIG. 50.



Both sulci closed ; crown stitch in place.

FIG. 51.



All sutures tied.

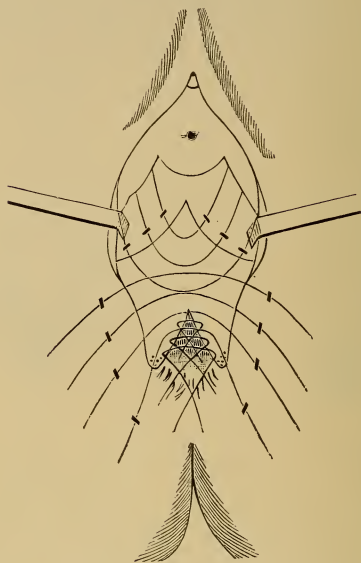
face one-fourth inch from the edge of the tear, carry it up directly through the external sphincter and beyond through the lip of the wound close to the rectal wall and parallel with it, pass it across above the angle of the tear just short of the mucous membrane of the rectum and carry it down symmetrically through the opposite lip. (Figs. 51, 52.) A second silkworm-gut suture is passed in similar manner in a plane a little more remote from the rectal wall.



The remainder of the wound is then closed as in incomplete lacerations.

Anterior or lateral tears of the vagina or of the vulvo-vaginal orifice should be sutured.

FIG. 52.



Tear entering rectum ; sutures laid in three series, one rectal, one vaginal and one from the skin surface.

Old lacerations sustained in a previous labor, and which have not been repaired, may sometimes be repaired with advantage at this time. The method does not differ from that usually employed in the secondary operation.

*After-care.*—It is unnecessary to bind the knees together.

The catheter is usually required for a time after suture of the pelvic floor. It should be omitted if possible. Care must be used to prevent the urine from trickling into the vagina or over the wound surfaces.

The bowels are opened on the second day and once daily thereafter. The nonabsorbable sutures are removed on the eighth or ninth day.

### Care of the Patient at the Close of Labor.

*Retraction of the Uterus.*—For at least a half hour after delivery of the placenta the uterus must be watched, holding the hand over it upon the abdomen. Gentle friction is used if necessary to promote contraction. One or two doses of the fluid extract of ergot of a half drachm each are generally required, especially when chloroform has been given. Ergot is useful as a prophylactic, not only against postpartum hemorrhage, but against puerperal infection, since it tends to prevent the formation and retention of blood-clots in the uterus. Moreover, by limiting the blood-supply it promotes involution. It may be administered by the mouth or subcutaneously.

*Cleansing.*—The nurse bathes the external genitals and soiled parts of the patient's body with sterilized water or with a weak antiseptic solution, and changes her linen and bed-linen if soiled. Fresh boiled cheese-cloths, not sea-sponges, are to be used for bathing. Sea-sponges are difficult to clean.

*Vulvar Dressing.*—The external genitals are covered after cleansing with a dressing, the lochial guard. A folded napkin is commonly used. It should be sterilized by steaming or boiling and dried before using.

Instead of the napkin a special dressing may be made of absorbent cotton, cotton batting, cotton-waste or other absorbent material loosely packed in a cheese-cloth envelope. It should be ten inches long, four inches wide and two inches thick. A tail-piece about ten inches long at each end of the pad serves for pinning to the abdominal binder. The pads are burned after using.

**Draw-Sheet.**—This is a clean sheet folded to four thicknesses. It is placed under the patient's hips to protect the bed, and changed as often as soiled.

**The Abdominal Binder** is best made of a straight piece of unbleached muslin, a yard and a quarter long and half a yard wide. When applied it should reach just below the trochanters; it ought to be moderately tight for the first twelve hours, subsequently looser.

The binder is not indispensable, but the support it gives is usually grateful to the lying-in woman during at least the first few hours or days after labor.

**The Condition of the Mother**, especially the pulse and the temperature, the amount of lochial flow and the firmness of the uterus, should be noted before leaving.

**Instructions to the Nurse.**—The nurse should receive directions with reference to the care of the patient and particularly in the matter of sleep, diet, evacuations of the bladder, nursing the child and watching the amount of bloody flow. A drachm of the fluid extract of ergot may be left with the nurse to be given in the event of hemorrhage, a grain or two of opium, or its equivalent, for use if required for severe after-pains, and a suitable antiseptic to be used in cleansing the genitals. All needed instructions should be given with reference to the care of the child. Within the first hour or two after birth the navel should be reexamined for possible bleeding.

## CHAPTER IV.

### PHYSIOLOGY OF THE PUERPERAL STATE.

#### COURSE AND PHENOMENA.

**Post-partum Chill.**—Frequently a chill follows the birth of the child. It is due probably to the lessened heat-production incident to the abrupt cessation of the muscular efforts of labor and has no pathological significance.

**The Pulse-rate.**—The pulse-rate as a rule falls shortly after labor below the usual standard. For a period of a week or more it may remain below 60, in exceptional instances as low as 40, to the minute.

**Temperature.**—The maximum physiological temperature for the first four or five days of the puerperium is  $99\frac{1}{2}^{\circ}$ , thereafter  $99^{\circ}$  F. A rise of one or two degrees above these limits though common is not to be regarded as strictly physiological.

**Urination.**—Owing to lowered intra-abdominal pressure, to urethral spasm, to the bruised, swollen and sensitive condition of the structures about the urethra and to other causes, the patient is liable to retention of urine in the first few days following labor. The secretion is greatly increased after child-birth and over-distention of the bladder not infrequently results.

**Peptonuria.**—Peptonuria is normal in the puerperal state, peptone being a product of uterine involution.

**Bowel Movements.**—Sluggish action of the bowels is the rule.

**Condition of the Uterus.**—The upper segment is thick and moderately firm. The lower segment remains thin and relaxed for about twelve hours after child birth. Subsequently it gradually regains its shape and firmness.

The lymph-spaces or blood channels are greatly enlarged, a condition favorable to resorptive activity and which constitutes one of the elements of septic danger in the lying-in period.

*The Cavity.*—The deeper layer of the decidua remains to be shed piecemeal during the lochial flow. Shreds of the outer superficial layer, too, are retained to be loosened and discharged with the lochia. The placental site is slightly elevated above the general surface and is studded with small blood-clots lodged in the mouths of the vessels. The cavity at first contains blood and blood-clots and later its walls are smeared with a muco-sanguinolent fluid.

**Involution.**—Involution is the process by which the hypertrophied structures of the uterus and other genital organs are restored to the non-gravid condition normal to the parous woman. It is essentially a process of fatty degeneration resulting from the lessened blood-supply. The endometrium is wholly renewed.

*Uterus.*—The uterus at the close of labor measures, externally, 10 to 12.5 cm. in width by 18 to 20 cm. in length, 4 or 5 by 7 or 8 inches; the thickness of its walls is 2.5 to 3.7 cm., 1 to 1½ inch; the depth of the cavity is

At the close of labor, about	.	.	15.0 cm., 6 inches.
“ tenth day	.	.	10.7 “ 4½ “
“ second week	.	.	9.7 “ 3¾ “
“ third week	.	.	8.8 “ 3½ “
“ fourth week	.	.	8.0 “ 3¼ “

After involution is complete the thickness, the width and the length of the uterus are approximately 1, 2 and 3 inches respectively.

It will be seen that in the parous woman the organ is somewhat larger than in the virgin state.

*The situation of the fundus* at the close of labor is nearly midway between the umbilicus and the pubic bones; a few hours later it is just above the umbilicus and usually the uterus is dextroverted; by the tenth day, if involution has gone on normally, it is at the level of the brim. The height of the fundus, however, varies with the fulness of the bladder and the rectum.

*The weight of the uterus* at the termination of labor is about thirty-five ounces, at the end of the first week it is sixteen; at the end of the second week, twelve; and at the end of the third week, eight ounces. After involution is complete it weighs ten to thirteen drachms—one and a half ounce nearly.

*The duration of uterine involution* is usually six weeks, but it frequently reaches eight or even ten weeks.

Involution of the uterus is slower in non-nursing women, after twin births, premature labor, much hemorrhage, retention of secundines, and is partially arrested in endometritis and by getting up too soon. It may be retarded by violent emotional disturbance.

*The Cervix.*—The cervix is soft and shapeless, having an almost gelatinous consistence at the close of labor. Within twelve hours it begins to be gradually re-formed.

The os internum is large enough to admit two fingers at the end of twenty-four hours. The os externum will admit one finger after seven to fourteen days. Involution goes on proportionately to that of the body of the uterus.

The lower border is permanently notched to a greater or less extent in parous women.

*The Vagina.*—The hypertrophied vaginal walls are much relaxed after labor. Their involution progresses with that of the uterus; the vagina is not wholly restored to the nulliparous condition, however.

*Other Pelvic Structures.*—The ovaries and tubes, the muscular structure of the pelvic floor, of the abdominal walls and all other structures which have undergone hypertrophy during pregnancy participate in the retrograde process and are partially or wholly restored to their ante-partum state.

*After-pains.*—Periodical uterine contractions continue for a few hours or days post-partum; usually they are more or less painful in multiparæ owing to the greater relaxation of the uterus in women who have borne children and the consequent liability to retention of blood-clots at the close of labor. Generally they are not so in primiparæ. They accomplish and maintain the retraction of the uterus and are, therefore, conservative when not too severe. Normally they cease altogether by the third or fourth day. After-pains are likely to be intensified while the child is nursing.

*The Lochia.*—The lochia are the genital discharges which follow labor. They are more or less bloody for four or five days, *lochia rubra* and they contain shreds of decidua and of placental tissue; then they become sero-sanguinolent, *lochia serosa*, for two or three days; finally they are of a creamy appearance, *lochia alba*, and contain fat-granules, epithelial cells, leucocytes and cholesterin. For a week or more after labor their reaction is alkaline, then neutral or acid. The total amount is about three and a



quarter pounds. The duration of the discharge is in normal cases from two to four weeks.

### MANAGEMENT OF THE PUERPERAL STATE.

**Post-partum Visits.**—As a rule the patient should be seen within twelve hours after labor, except when a competent graduate nurse is in charge, and once or twice daily for the first three days; once daily thereafter until the seventh is the rule in normal cases. Occasional visits should be made during the remainder of the post-partum month.

*The First Visit.*—A systematic examination should be made at this and each succeeding visit. The general condition of the mother, the pulse and the temperature should be noted. Learn the amount and character of the lochia. The binder should be loosened and the uterus examined by the abdomen for size, firmness, tenderness. Observe in the abdominal examinations whether the bladder is over-filled. Learn if it has been evacuated and the quantity of urine voided. Inquire if the patient has had sufficient sleep and proper diet. The child should be looked after. Ascertain whether it has passed urine and meconium as evidence that the passages are pervious; if there has been any discharge from the eyes or bleeding from the navel, and what the temperature is per rectum.

*Subsequent Visits.*—Especially to be observed at the daily visits are the pulse, the temperature, the condition of the breasts, nipples, bladder, the amount and character of the lochia, the involution of the uterus and the general condition of the mother. The pelvic contents should be examined by the bimanual method once or more during the third or fourth week. Observe whether the introitus

vaginæ is normally closed, the vagina intact, the broad ligaments free from exudates or adhesions, whether the cervix is lacerated or gaping, and note the size, shape, position, density and mobility of the uterus.

Too long continuance of the lochia is usually associated with some degree of sepsis in the uterine cavity. Persistence of the bloody flow in the third week, especially if accompanied with sacral pain, should excite suspicion of retrodisplacement of the uterus.

The case should not be dismissed wholly until involution is complete and the pelvic organs are entirely restored to the normal non-gravid state.

The condition of the child should be noted at each visit.

**Evacuations of the Bladder.**—Owing to the danger of overdistention the bladder should be emptied within six hours after labor and once in six or eight hours subsequently.

**Retention of Urine.**—Inability to void the urine may sometimes be relieved by hot fomentations over the meatus urethræ, a rectal injection of warm water, suprapubic pressure and if need be a sitting or half-sitting posture during attempts at urination. After the first six or eight hours it is generally better to allow the patient to get out of bed to use a commode than to pass the catheter. When the labor has been unusually severe or the pelvic floor has been badly torn and been sutured the patient must constantly keep the recumbent posture for at least several days.

**Bowel Movements.**—The bowels are to be opened on the second or third day and once daily thereafter. For this purpose a simple laxative, an enema of warm water, Oj, or of a saturated solution of Epsom salt, ʒj-ij, or a

rectal injection of undiluted glycerin may be given. For internal use citrate of magnesium, the compound rhubarb pill, fluid extract of cascara or a cascara tablet is suitable. In case of hemorrhoids a quarter grain of the aqueous extract of aloes is recommended.

**After-pains.**—After-pains, if severe enough to prevent sleep, may be relieved by one or two doses of opium, gr.  $\frac{1}{2}$ —j, by phenacetin, gr. v, by chloral hydrate, gr. xx, or by inhalation of 5 or 6 minims of nitrite of amyl. The use of opium, however, should be avoided if possible.

**Restorative Measures.**—Restorative measures are rest and sleep, as generous a diet as the patient can digest, tonics (iron, quinine and strychnine) and sometimes stimulants. Sleep is especially important.

**Antisepsis.**—Strict cleanliness of the patient's person, linen and bed-linen is imperative.

The nurse should change the vulvar dressing every three to six hours during the first three days, and thereafter often enough to prevent the least putrefactive odor. The external genitals, their immediate surroundings and other parts of the body which may be soiled by the discharges, should be cleansed carefully with an antiseptic solution at each change of the dressing. Vaginal or uterine douches are to be used only in the presence of sepsis or of fetor not controlled by rigid external cleanliness.

The nurse should be scrupulously clean. She should wear wash dresses, frequently changed, and be as careful in the observance of a strict asepsis as the doctor is required to be.

**Diet.**—Usually the diet must be restricted to liquid or light solid food for the first day, often for a longer period

if the patient is much exhausted or has taken an anæsthetic. Milk, gruels, beef essence, animal broths, soft-cooked eggs, oysters, boiled custard, oatmeal mush or wheaten grits well cooked, dry toast and weak tea or cocoa are suitable. After the first two or three days, in the absence of exhaustion, fever, indigestion or loss of appetite, a moderately full diet generally may be permitted. Convalescence goes on more rapidly under proper feeding. Either excess or too great a restriction in the matter of diet must be avoided. Pains must be taken to adapt both the quality and the quantity of food to the needs of the individual patient.

**Tardy Involution of the Uterus.**—Useful measures for promoting involution are the following: Gentle friction applied for ten minutes, twice daily, with the hand on the abdomen; the abdominal wall is moved in a circular direction over the uterus; galvanism may be used, ten to twenty milliamperes, one electrode over upper part of the sacrum, one upon the abdomen over the uterus, sitting ten minutes twice daily; faradism applied in a like manner, is still more effective. Extract of ergot, gr. j, t. i. d., is useful. A hot vaginal douche, two or three gallons, temperature 120° F., once or twice daily, yields good results. Curetting is indicated in case of hypertrophied decidua.

Active interference is not called for in slight departures from the normal rate of involution. Here all that is needed is a little longer period of rest than is the rule in strictly normal conditions.

**Use of the Catheter.**—Catarrh of the vesical neck frequently results from infection carried on the catheter. Catheterism, therefore, should be withheld if possible, and when required should conform to the following rules:

The instrument, if to be used by the nurse, should be a soft-rubber catheter. The catheter is boiled for ten minutes immediately before using, and after sterilizing must be handled only with surgically clean hands.

The patient lies on the back with the knees drawn apart. She or an assistant retracts the labia to fully expose the meatus urethræ and holds them apart until the catheter is passed.

The meatus and its surroundings are carefully cleansed and disinfected.

The catheter, lubricated with sterilized vaselin, is passed 4 cm., about  $1\frac{1}{2}$  inch, or until the urine begins to flow.

The urine is collected in a cup or small bowl. The evacuation of the bladder is repeated every eight hours. Care should be taken to prevent the entrance of urine into the vagina and its contact with genital wounds. The instrument is cleansed carefully after using.

Washing out the bladder with a few ounces of sterile saturated boric acid solution after catheterizing is useful as a prophylactic against cystitis.

#### Regulation of the Lying-in Period.

*First Week.*—The patient keeps the bed. As a rule, after the first few hours she may assume a half-sitting position, if necessary, for evacuation of the bladder or bowels.

*Second Week.*—She maintains a recumbent posture on the bed or lounge; may sit up in bed during meals and for urination and for bowels movements.

*Third Week.*—She sits up in a chair all or part of the day.

*Fourth Week.*—The patient has the liberty of the room ; at the end of the month, if all goes well, she can leave the room.

The duration of the lying-in, however, must obviously vary according to the rate of uterine involution and the general progress of convalescence.

### LACTATION AND NURSING.

**Colostrum** is the thin, slightly viscid, yellow liquid furnished by the mammary glands of the puerpera before the true milk secretion begins. It contains epithelial cells, fat-globules and certain bodies called colostrum corpuscles, and is rich in proteids and saline matter. To the latter are ascribed by some authorities its moderate laxative properties. Normally no colostrum corpuscles should be found in the milk after about the tenth day.

**The true milk secretion** is usually established by the third day in primiparæ, the second in multiparæ.

**Signs of deficient lactation** are : Mother's breasts persistently flabby, child not satisfied and showing signs of inanition. The milk may be at fault in quality or in quantity. Clinically the best evidence of the amount and character of the milk secretion is to be had by noting whether the infant gains normally in weight. The average gain is five or six ounces per week for the first five months, and a pound monthly for the remainder of the first year. The child's weight should be taken weekly.

The secretion is at fault in quantity, quality, or both, in from 10 to 20 per cent. of mothers.

**Measures for Increasing the Secretion.**—Generous diet, milk, tonics, especially strychnine, and attention to

hygiene are the best galactagogues. Milk may be taken as a part of each meal, not as an addition to the usual feeding. Used in this manner it is generally well borne. Faradism applied directly through the breasts, once or twice daily, positive pole on nipple, may help. Somatose 3 or 4 teaspoonfuls daily in cocoa or in milk has some value. Beans, lentils, parsnips and most foods containing phosphorus, increase the quantity of milk. Thyroid extract, gr. j, three or four times daily, improves the quantity and quality of the secretion; massage of the breasts and especially of the abdomen from below upward with a view to increasing the blood supply to the breast helps. Malt liquors are not to be recommended as galactagogues. Coffee diminishes the secretion of milk.

**Care of the Breasts and Nipples.**—The nurse should cleanse the nipples after each nursing with a bland antiseptic solution, such as a saturated aqueous solution of boric acid to which one-eighth part of glycerin has been added. It is well to cleanse the child's mouth in like manner before nursing. The nurse should be warned of the risk of carrying infection to the nipples or to the child when her hands are frequently soiled with lochia. Excessive nursing must not be permitted. The nipple is injured by long-continued maceration.

Gentle massage of the breasts may be useful in simple milk engorgement; it should be prohibited in inflammation.

Painful distention of the breasts may be relieved by saline cathartics and partial abstention from liquids, and by the use of the compression binder firmly applied.

**Contra-indications to Suckling the Infant.**—Among the conditions which should prohibit nursing are recent



syphilis if the child is not infected, tuberculosis, marked anæmia, epilepsy, poor quality or very deficient quantity of milk, pregnancy.

### THE CHILD.

#### Condition at Birth.

**Weight.**—The weight of the newborn infant is from 3175 to 3288 grammes, 7 to  $7\frac{1}{4}$  pounds, males weighing more than females by about a quarter of a pound, and first less than subsequent births.

A loss of weight takes place during the first three days, amounting to six or eight ounces. Normally the child regains its initial weight by the end of the first week or ten days. The birth-weight is doubled at five months and trebled at fifteen.

**Measurements.**—See page 92.

**Temperature.**—The temperature ranges from  $98.6^{\circ}$  to  $99^{\circ}$  F., but is easily influenced by slight causes. Considerable elevation of temperature is frequently observed in innutrition of newborn infants.

**Circulation.**—The pulse-rate ranges from 120 to 140 per minute. The ductus arteriosus, the ductus venosus and the umbilical vein are obliterated in a week or ten days. The foramen ovale generally closes within the same period; sometimes the upper part remains permanently open. The umbilical arteries are obliterated in their upper portions within five days, the lower parts remaining open to form the superior vesical arteries.

**Respiration.**—The respiratory tract is devoid of air till the first respiratory effort, and the lungs are therefore collapsed. The air-tract may contain blood and vaginal mucus drawn into it by premature efforts at respiration.

The first respiratory movement is due in part to air-hunger from arrest of the maternal supply of oxygen, and in part to reflex contraction of respiratory muscles excited by contact of air with the moist surface of the skin. The average rate of respiration in the newborn infant is 45 per minute.

**Skin.**—The skin of the child's back and of the flexor surfaces of the limbs is more or less thickly covered with a cheesy coating, the vernix caseosa, which consists of fatty matter, epidermal scales and sebaceous material. The epidermis is partly exfoliated in the first two or three days, leaving the skin red and irritable.

**Bowels.**—The contents of the intestines, meconium, consist of intestinal secretions and bile, together with lanugo and epidermal scales derived from swallowed liquor amnii. The meconium is passed off and the stools become feculent within the first three or four days.

**Genito-urinary Organs.**—The bladder usually contains urine at birth. The specific gravity of the urine is 1005 to 1010. Albumin and sometimes sugar are present. Uric acid deposits simulating blood stains are often observed on the napkin.

In boys both testicles have descended into the scrotum. The preputial orifice is usually too small to permit easy retraction of the foreskin. The prepuce is normally adherent to the glans in the newborn; sometimes it requires to be stripped back by freeing the adhesions when the latter are abnormally firm and give rise to irritation.

**Nervous System.**—The nervous system is much more irritable and the nerve-centers more unstable than in later life.

**Special Senses.**—The sensibility of the skin is feeble at birth, but it is fully established within the first day or two. The taste is sensitive to strong impressions.

The newborn infant is deaf at birth, since the meatus is closed and the middle ear devoid of air. Loud sounds are audible within a few hours. The retina is sensitive to light.

**Secretions.**—*The lachrymal and the sweat glands* are not, as a rule, developed in the first few months. Little saliva is secreted. The amylolytic function is feeble during the first few months.

**Caput Succedaneum.**—The caput succedaneum usually subsides within twenty-four hours, and the distortion of the head from moulding disappears in the course of two or three weeks.

#### Management of the Newborn Child.

**Respiration.**—To inflate the lungs, provoke deep inspirations by blowing upon the face, by dashing a few drops of cold water upon the face and chest, or by gentle flagellation. Suspending the child by the feet promotes drainage from the respiratory tract and at the same time the flow of blood to the brain.

**Asphyxia Neonatorum.**—Asphyxia in the newborn infant is generally the result of injuries sustained during birth. Compression of the cord, premature separation of the placenta, pressure upon the foetal head in prolonged and difficult labors and especially in forceps operations, are among the most common causes. The prognosis varies with the degree of asphyxia. It is generally good in the cyanotic and grave in the pallid stage.

**Treatment. Preparatory Measures.**—Clear the mucus from the throat with the finger wrapped with a wet

soft linen, or, better, by aspiration with a soft-rubber catheter. In marked venous congestion one or two drachms of blood may be allowed to flow from the cord. If the child is pale and collapsed a rectal injection of water, at a temperature of  $105^{\circ}$  to  $108^{\circ}$  F., should be given. Suspension by the feet is useful. The normal temperature is best maintained by keeping the child's trunk and lower extremities for the larger part of the time immersed in water at  $98\frac{1}{2}^{\circ}$  F.

*Direct Insufflation.*—The child is laid upon its back ; the head is partially extended by placing a fold of blanket under its neck ; the face is cleansed and covered with a clean towel. To prevent inflation of the stomach the hand is held firmly on the epigastrium. With the mouth against the towel directly over the child's mouth the operator expands its lungs by breathing gently into them. This is repeated sixteen to twenty times per minute as long as the heart beats.

*Schultze's Method.*—Suspend the child by the shoulders, face from the operator, holding a thumb in front and two fingers over the posterior aspect of each shoulder with an index finger caught in each axilla—inspiration. The pressure of the thumbs should be relaxed to assist inspiration.

Invert the position by swinging the trunk and lower limbs upward and toward the operator's face, flexing the body in the lumbar region—expiration.

In feeble infants this method must be used with great caution, if at all, owing to the shock involved. This and direct insufflation are the most effectual methods for the resuscitation of stillborn infants.

*Sylvester's Method.*—Place the child in a supine position, with the head well extended by a fold of blanket under

its neck. For inspiration draw the arms well above the head. For expiration place them by the sides and gently compress the thorax.

*Byrd's Method.*—The child is held supine upon the hands of the operator at right angles to the forearms. For inspiration the radial borders of the hands are lowered; for expiration they are raised.

*Faradism.*—A weak faradic current may be employed when the respiratory movements are persistently feeble; one pole is applied to the nuchal region and the other over the epigastrium.

*Laborde's Method.*—Gentle intermittent traction on the tongue.

**Incubation.**—An infant prematurely born will generally require to be kept in an incubator for as many weeks as it is premature. It should be removed from it only for feeding or bathing. The temperature in the incubator should at first be about  $90^{\circ}$ , and gradually be lowered to that of the room during the few weeks preceding the final removal of the child. A thermometer is kept in the compartment with the child. Ample ventilation must, of course, be provided.

**Rectal Injection.**—It is well to order a rectal injection of a tablespoonful of warm water to be given soon after birth as a means of detecting at once possible occlusion of the rectum—atresia ani.

**Bathing.**—The face is bathed on birth of the head and the eyes are cleansed and carefully dried as a prophylactic against ophthalmia. The instillation of a drop of Credé's solution (nitrate of silver, gr. x ad ʒj), or of a protargol gr. xl ad ʒj, is the rule in hospitals and may be practiced in private cases. It should not be omitted in family

practice when there is reason to suspect that the secretions of the birth canal are infectious.

Protargol is much less irritating than the nitrate of silver and is equally effective.

A few drops of lemon juice may be substituted for silver salts (Pinard).

The body is smeared with sweet oil or vaselin to facilitate the subsequent removal of the vernix caseosa.

For the first few months after the cord falls, the full bath may best be given by immersion. A morning hour should be chosen midway between feedings. The temperature of the water should be  $98^{\circ}$  F. by the bath thermometer; that of the room,  $75^{\circ}$  F. The least chilling is injurious.

The duration of the bath should not exceed five minutes. From the standpoint of asepsis a soft, fresh-boiled cheese-cloth is preferable to a sea sponge. Only a bland, mildly alkaline soap (castile) should be used, and little of that. Special attention should be given to the scalp. The full bath is repeated daily in the summer, daily or every other day in the colder months. Parts of the body exposed to soiling must be cleansed as often as soiled.

In puny and anæmic children the full bath is best postponed for several hours or days. A partial sponging, or anointing daily with sweet oil or vaselin, may be substituted. Infant powder is generally unnecessary.

**Navel Dressing.**—The stump of the navel cord is dressed with dry sterile absorbent cotton; turn to the left side to avoid injurious pressure on the liver, and retain by a loose abdominal binder. Rapid desiccation is the chief reliance for preventing putrefactive changes in the stump, and the dressing should be ordered accordingly. Powders

tend to hinder the drying and are best omitted. Bathing with strong alcohol and saturating the cotton with the same at the first dressing promotes desiccation.

The dressing should be renewed after each bath. After the first bath, anointing with sweet oil may be substituted for bathing till the cord falls. This usually occurs about the fifth day.

It is imperative that the navel wound be kept surgically clean. Septic infection of the navel may result in umbilical phlebitis, pyemia and death.

**Clothing.**—For the first half year or more the following is recommended :

1. Napkin of cotton diaper.
2. An undershirt of the softest silk and wool, without sleeves, and opening in front.
3. A fine flannel princesse dress with high neck and long sleeves, opening in front, and about twenty-five inches in length.
4. A muslin slip of similar style.
5. Woollen socks.

During the night the socks may be removed and the muslin and the flannel slip be replaced with a light flannel night-dress.

The belly-band and all bands in the clothing should be loose enough to admit two or three fingers underneath them. The belly-band should be discarded after the navel heals. In all seasons the skin should be protected with woollen undergarments and the extremities should be as warmly covered as other parts of the body are. No garment ought to be worn till laundered.

**Nursing.**—The child is put to the breast after the mother has recovered from the shock of labor, usually



within from eight to twelve hours. Ten to fifteen minutes may suffice for each nursing.

The usual frequency is once in four hours for a day or two, then every two hours. The milk becomes too rich with too frequent nursing, too thin with too long intervals. One interval in the night is lengthened to four or six hours. It is well to wake the child, if necessary, on the hour. The intervals should be extended to three hours by the time the child is three months old. As a rule, one or more artificial feedings daily will be required after the seventh or eighth month.

*Wet-nursing.*—A good wet-nurse should be of mature age, below thirty-five, and preferably a multigravida. Her child ought to be of the same age as the foster child within one or two months. A menstruating woman is sometimes unsuitable, a pregnant one always. Sound physical and mental health is indispensable. She should be examined especially for tuberculosis, syphilis and other contagious diseases. The breasts should be of somewhat conical form, well developed, with prominent veins and well-formed and healthy nipples. The condition of the nurse's child speaks for the quantity and quality of her milk.

*Weaning.*—The time for weaning, as a rule, is after the child has cut eight teeth, except when that period falls in the hot months.

**Evacuations of the Bowels and Bladder.**—In health the number of bowel movements is from two to four daily. Urination is repeated every one to four hours.

**Sleep.**—The newborn infant requires eighteen to twenty hours' sleep out of the twenty-four.

**Artificial Feeding and Infant Dietary.***First Twelve Months.*

Cow's milk should be the basis of the substitute food for at least the first year and a half of life.

Mixed dairy milk is better than one cow's milk because of more nearly constant quality.

The milk should be fresh and free from impurities. Uncleanliness, of itself poisonous, greatly impairs the keeping qualities of the milk.<sup>1</sup>

Sterilizing by heat destroys the germ content and retards fermentative changes; it does not destroy the products of fermentation.

Heating to high temperatures impairs the nutritive value of the milk. Heating to 150° F. for twenty minutes works a minimum of injury and is advisable when the cleanliness of the milk cannot be trusted and especially during the hot months.

Milk that is collected and handled with strict cleanliness, that is chilled below 60° F. within a few minutes after milking and is kept so needs no sterilizing.

Such milk may be had in some of the larger cities from dairies especially conducted in the interest of infant feeding.<sup>2</sup>

**Modification of Cow's Milk.**

The proportions of the principal nutritive ingredients in human and in cow's milk are approximately as follows :

<sup>1</sup> Tablets for testing the freshness of milk may be had of the druggists or of the Cereo Company, Tappan, N. Y.

<sup>2</sup> The Walker-Gordon Company, New York City, the Certified Milk Co., New Jersey.

Human milk : Proteids 1 to 2 per cent., fat 3 to 4 per cent., sugar 7 per cent.

Cow's milk : Proteids 4 per cent., fat 4 per cent., sugar 4 per cent.

*Ratio of Proteids to Fat.*—The proportion of proteids to fat in the substitute food should be about as follows :

First four months : 1 : 3.

Next six months (to end of tenth) 1 : 2.

Subsequently nearly or quite 1 : 1, whole milk.

How to obtain milk containing any required proportion of proteids and fat is obvious from the following facts :

The milk is bottled at the dairy. The cream will all have risen to the upper third of the bottle after standing four hours on ice. Usually the milk will be found to have creamed fully when delivered, the line of demarkation between cream and under milk being plainly visible.

The upper third of a quart bottleful of milk after creaming (about ten ounces) will contain 12 per cent. of fat ( $4 \times 3 = 12$ ).

The upper half, 8 per cent. of fat ( $4 \times 2 = 8$ ).

The mixture of milk and cream from the top of the bottle is termed top-milk.

The percentage of fat in any other top-milk may readily be computed.<sup>1</sup> Ten-ounce and sixteen-ounce top-milk are most used.

The percentage of proteids and of sugar is the same in all top-milk as in the whole milk.

The top-milk is best removed by ladling it off with a small ladle or dipper,<sup>2</sup> or by syphoning off the under milk.

<sup>1</sup>The foregoing figures while not exact are sufficiently so for practical purposes.

<sup>2</sup>A one-ounce dipper specially devised for the purpose by Dr. Henry Dwight Chapin may be had of the Cerec Co., Tappan, N. Y.

**Diluents.**—The strength of the food is regulated by dilution, the extent of which at different weeks of age is shown in the formulas on pp. 193–4 and in the table on p. 197.

The diluent may be sterile water, dextrinized gruel or whey.

Gruel or whey is generally the best diluent since it prevents the casein from forming tough curds in the child's stomach.

**Dextrinized Gruel** is prepared as follows: A tablespoonful of barley, wheat or rice flour is rubbed to a paste with cold water and boiled for 20 minutes in a pint of water. After cooling to 100° F. a teaspoonful of cereo or of Forbe's diastase is added to the gruel which is allowed to stand for ten minutes.<sup>1</sup>

**Sugar.**—To bring the percentage of sugar up to the standard of human milk, milk sugar is added. It is convenient to remember that one ounce (about two and a half tablespoonfuls) of milk sugar to twenty ounces of mixed food adds 5 per cent. of sugar.

**Alkalinity.**—Since cow's milk is generally acid, while human milk is alkaline, 5 per cent. of lime water (1 ounce to 20 of the mixed food) is added.

**Whey.**—Whey is prepared by adding one drachm of essence of pepsin (Fairchild), or one or two grains of scale pepsin to a pint of milk at a temperature of 115° F. After the curd separates the whey is strained off through two or three thicknesses of cheesecloth or through a wire gauge strainer.

Whey contains about 1 per cent. proteids, .22 per cent. of fat and about 4 per cent. of sugar.

<sup>1</sup> Dextrinizing at a temperature above 100° F. causes an unpleasant taste of malt.

If the curd is stirred before straining the percentage of fat is raised to about 2 per cent.

The proteid strength may be increased by adding white of egg. The white of one egg of medium size added to a pint of food adds about 1 per cent. of proteids.

In feeble digestion whey may be used for a few days to the exclusion of other foods. As a diluent it yields a fine coagulum and has the advantage that its proteids are easily digestible. The proteids of cow's milk are chiefly ( $\frac{5}{8}$ ) casein, which is difficult of digestion.<sup>1</sup> By the use of whey it is possible to raise the percentage of proteids to a limited extent, without impairing the digestibility of the food. The whey should be heated to 150° F. to kill the ferment before mixing with the top milk, otherwise the top milk will be curdled.

The following formulas may be found convenient for general guidance in regulating the strength of the feeding :

### Food Formulas.

#### *For a Newborn Infant.*

Ten-ounce top-milk . . . . .	2 ounces.
Sterilized water or sterilized gruel . . . . .	14 “
Milk sugar (two and a half tablespoonfuls) . . . . .	1 ounce.
Lime water, about . . . . .	$\frac{3}{4}$ “

#### *Latter Part of Third or Fourth Month.*

Ten-ounce top-milk . . . . .	10 ounces.
Dextrinized gruel or sterilized water . . . . .	20 “
Milk sugar . . . . .	1½ ounce.
Lime water . . . . .	1½ “

<sup>1</sup>The proteids of human milk are only one-third casein. The remaining two-thirds are easily digestible proteids.

*Beginning of Fourth or Fifth Month.*

Sixteen-ounce top-milk . . . . .	8 ounces.
Dextrinized gruel . . . . .	24 “
Milk sugar . . . . .	1½ ounce.
Lime water . . . . .	1½ “

*Latter Part of Tenth Month.*

Sixteen-ounce top-milk . . . . .	32 ounces.
Dextrinized gruel . . . . .	16 “
Milk sugar . . . . .	2 “
Lime water . . . . .	2 “

*Tenth to Twelfth Month.*

Whole milk . . . . .	32 ounces.
Gruel plain or dextrinized . . . . .	16 “
Milk sugar . . . . .	2 “
Lime water . . . . .	2 “

*Whey Mixtures.*

No. 1. Whey . . . . .	18 ounces.
Cream (six-ounce top-milk). . . . .	3 “
Sugar (two tablespoonfuls). . . . .	$\frac{2}{3}$ ounce.
Lime water . . . . .	1 “
No. 2. Whey . . . . .	20 ounces.
Cream (six-ounce top-milk). . . . .	5 “
(Sugar two tablespoonfuls) . . . . .	$\frac{2}{3}$ ounce.
Lime water . . . . .	1 “

**Bartley's Formula.**—The top fourth is removed from the quart bottle of milk after creaming. Whey is prepared from the remaining three-fourths and, after heating to 150° F. and cooling, is mixed with top-milk. Milk sugar is add to the required percentage.

**Bottling.**—The food should be prepared soon after the milk is delivered and distributed in nursing bottles each holding enough for a single feeding. The bottles are kept on ice till required for use.

The food is fed at a temperature of 98° F., directly from the bottle in which it was prepared, a rubber nipple being slipped over the neck of the bottle.

Bottles and nipples are cleaned after nursing, and sterilized by boiling 20 minutes immediately before refilling.

### Regulation of the Strength and Quantity of Food.

—Care should be taken to increase the strength of the food by lessening the proportion of the diluent, as rapidly as the child's digestion will permit. The stomach capacity at birth is approximately  $\frac{1}{100}$  the body-weight of the child. As a rule it is an ounce for the first week and increases by a drachm and a half per week during the first five or six months. After that age the rate of increase is somewhat smaller.

The weekly weight of the child is a good guide in regulating the feeding. As already stated, a properly nourished child gains at least five ounces weekly during the first five months. For the remainder of the first year the average gain is about a pound per month. The birth-weight is doubled at five months and trebled at fifteen.

A watchful supervision must constantly be exercised in adapting the food to the requirements of individual cases.

The following table is intended for general guidance in regulating the amount and frequency of feeding.

**Amount and Frequency of Feeding.**

Age.	Intervals of feeding. <sup>1</sup>	Amount at each feeding. <sup>2</sup>	Number of daily feedings.
First day.....	2 hours.	1 drachm.	10
Second day.....	2 “	$\frac{1}{2}$ ounce.	10
Third day.....	2 “	1 “	10
Second week.....	2 “	$1\frac{1}{2}$ ounces.	10
Six weeks.....	$2\frac{1}{2}$ “	$2\frac{1}{2}$ “	8
Three months.....	3 “	$3\frac{1}{2}$ “	7
Six “.....	3 “	$5\frac{1}{2}$ “	6
Nine “.....	3 “	$6\frac{3}{4}$ “	6
Twelve “.....	$3\frac{1}{2}$ “	9 “	5

<sup>1</sup> Lengthen one interval in the night to four or six hours.

<sup>2</sup> By measuring-glass.



Small or feeble children should be fed more frequently and in smaller quantities, robust children in larger quantities.

### *Milk Laboratories.*

Laboratories for the modification of cows' milk for infant feeding have been established in several of the larger cities of the country. The physician writes a prescription for the food mixture very much as he does for medicine. The proportions for the essential ingredients in the formula, proteids, fat, and sugar are adjusted to the requirements of the individual case. The food mixture supplied daily from the laboratory is prepared according to the prescription, which is modified by the physician as occasion requires.

The following formula,<sup>1</sup> suitable for a healthy, full term infant, one week old, illustrates the method of prescribing.

R.—Proteids	.	.	.	.	.	.	.	.	0.50
Fat	.	.	.	.	.	.	.	.	1.50
Milk sugar	.	.	.	.	.	.	.	.	5.00
Lime water	.	.	.	.	.	.	.	.	5.00

Mix. Sterilize at 167° F.

Send 10 bottles of 1½ ounce each.

In weak albuminoid digestion the proportion of proteid is reduced to the minimum, 0.20 per cent., and gradually increased to the point of tolerance. A like modification is prescribed in the case of the fat or the sugar, should either of these and not the proteid element be found to be the source of the digestive disorder.

The following table shows the quantities of food and the percentages of proteid, fat, sugar, etc., required at

<sup>1</sup> The numerals in the formula represent percentages. It is understood that the rest of the 100 parts is made up with water.

different periods of the first year, as deduced from the experience of the milk laboratories of New York and Boston.

**Amount and Strength of Food.**

Age.	Stomach capacity.	Proteid.	Fat.	Sugar.	Lime-water.
Premature infants.	2-6 drms	0.20-0.50	1.00-1.50	3.00-5.00	5.00
Full term healthy infants.					
1 week.....	1 oz.	0.50	1.50	5.00	5.00
2 weeks.....	1½ "	0.75	2.00	5.00	5.00
3 ".....	2 "	1.00	2.50	6.00	5.00
4 to 6 weeks.....	2½ "	1.00	3.00	6.00	5.00
6 " 8 ".....	3¼ "	1.00	3.50	6.50	5.00
8 " 16 ".....	4 "	1.50	3.50	6.50	5.00
16 " 24 ".....	4½ "	1.50	4.00	7.00	5.00
24 " 32 ".....	5 "	2.00	4.00	7.00	5.00
32 " 34 ".....	5½ "	2.00	4.00	7.00	5.00
34 " 36 ".....	6 "	2.25	4.00	7.00	5.00
36 " 40 ".....	6½ "	2.50	4.00	6.50	5.00
40 " 44 ".....	7 "	3.00	4.00	5.00	5.00
44 " 48 ".....	7½ "	3.50	4.00	4.50	5.00
48 " 52 ".....	8 "	4.00	4.00	4.00	5.00

*Twelve to Eighteen Months.*

The child may take four or five feedings daily of whole milk with wheat, barley, rice or oatmeal gruel in the proportion of one-third the mixture. The gruel may be somewhat thicker than that used in the preceding months. Two or three ounces of uncooked beef-juice, moderately seasoned, may be given daily; it may be mixed with the milk or be given separately. It must be prepared at least twice a day and kept on ice. Care must be taken that the beef is fresh.

After the child has sixteen teeth the simpler kinds of food requiring mastication may be added, such as oatmeal and milk, or wheaten grits, thoroughly cooked, or stale bread and milk. Scraped beef or soft-boiled eggs may be allowed two or three times weekly.

*Eighteen Months to Two Years.*

The number of feedings may be four or five daily. A little fine cut meat, such as tender beef, lamb or chicken, may be added to the mid-day meal if the child is robust.

Milk should be the chief reliance for feeding till the child has all its teeth and may constitute a part of its food for several years longer. Milk, beef-juice and the farinaceous preparations above mentioned afford an ample dietary for the entire period of infancy. Proprietary foods for infants are not to be recommended.

**DISORDERS OF THE NEWBORN INFANT.***Constipation.*

**Treatment.**—Regulate the digesting and the feeding. Enough cream may be added to the food to raise the proportion of fat to 4, 5 or 6 per cent. This alone frequently overcomes the constipation in bottle-fed infants. Even a moderate excess of fat, however, is not in all cases well borne.

Suitable laxatives are the following :

R.—Sodii phosphatis . . . . . gr. x.  
Sacchari lactis . . . . . gr. x.—M.

This may be given at one dose in a teaspoonful or two of water or of syrup of manna.

R.—Ext. sennæ fluid, deodorat, (N. F.) . . . ʒss.  
Potassii et sodii tartratis . . . . . ʒj.  
Glycerini . . . . . ʒss.  
Aquæ . . . . . ad ʒiv.—M.

Dose, a teaspoonful, p. r. n.

Phillips' milk of magnesia is an eligible laxative for infants. The dose is a teaspoonful.

Useful rectal measures are the injection of equal parts of glycerin and water,  $\mathfrak{z}\text{ij}$ , sweet oil,  $\mathfrak{z}\text{iv}$ , or warm water,  $\mathfrak{z}\text{j}$ . The use of a suppository of soap or cacao butter or a glycerin or gluten suppository generally provokes immediate action of the bowels. Yet glycerin suppositories may prove too irritating to the rectum for continued use.

### *Indigestion.*

**Symptoms.**—Flatulence, sour, green and curdy stools, vomiting an hour or more after nursing or feeding, restlessness, disturbed sleep, colic, failure of the normal gain in weight.

**Treatment.**—The treatment should consist mainly in the regulation of the nursing or feeding. The food is almost invariably the source of the trouble. Look to the health and habits of the mother. It is sometimes useful to dilute the mother's milk by giving the child a teaspoonful or two of warm water with the nursing. In acute indigestion all feeding should be stopped for several hours. For a time longer whey or dextrinized gruel may be substituted for milk. Sometimes the first thing needed is to relieve the stomach of its contents by lavage. Four to five  $\frac{1}{10}$ -grain doses of calomel given at intervals of a half hour may be useful.

### *Colic.*

**Treatment.**—Remove the cause, which is to be found in faulty digestion, by regulating the feeding.

For the pain chloral is almost a sovereign remedy. The dose is gr. j in water,  $\mathfrak{z}\text{j}$ , or in syrup of vanilla and water,  $\text{āā } \mathfrak{z}\text{ss}$ , repeated once to three times daily, p. r. n.; milk of asafetida  $\mathfrak{z}\text{j}$  by the mouth or  $\mathfrak{z}\text{j}$  per rectum is generally

effective; warm applications to the abdomen and warm rectal injections, 5j, are useful palliatives. The curative treatment must consist mainly of measures addressed to the digestive disorder.

### *Diarrhœa.*

**Treatment.**—The cause is generally indigestion. All feeding should be suspended for several hours. No milk should be allowed for 24 or 48 hours. White of egg or dextrinized gruel may be substituted. The strength of the gruel for this purpose may be 4 tablespoonfuls to the pint. Milk feeding when resumed must be begun cautiously. A mild laxative, castor oil or calomel or both, may be indicated to remove irritating material; then bismuth subnitrate, gr. x, may be given every one or two hours. Should this fail add camphorated tincture of opium, ℥iij to x, to each dose of the bismuth. Calomel is especially useful in case of vomiting; opium for pain, frequent stools or tenesmus. Number of stools should not be reduced below 4 daily. Irrigation of the colon once or twice daily with normal salt solution is indicated only in the presence of putrescible accumulations.

### *Thrush.*

**Symptoms.**—The mucous membrane of the mouth is studded with white patches, due to the presence of a fungus. The patches resemble milk-curds in appearance, but are distinguished from them by their firm adhesion and by the detection of the mycelia and spores of the parasite under the microscope.

**Treatment.**—To destroy the fungus sop the patches every two hours with a saturated solution of boric acid

or with a solution of sodium sulphite, one drachm to the ounce. For the stomatitis which persists after destruction of the fungus use a half-saturated solution of potassic chlorate, or better, as being less toxic, sodic chlorate, as a mouth-wash. The child must not be permitted to swallow any of these solutions. The accompanying gastrointestinal disorders are to be treated as in other cases.

### *Intertrigo.*

**Treatment.**—Keep the parts clean, with care to do no mechanical violence to the skin by too much friction. Use as an infant powder lycopodium and oxide of zinc, equal parts, dusted on the affected surfaces after cleansing, p. r. n. Talcum powder is a useful application.

### *Cephalhæmatoma.*

Cephalhæmatoma is an extravasation of blood, usually between the pericranium and the cranial bones; rarely it occurs internally. After a few days a hard ridge develops at the margin of the tumor owing to periosteal inflammation.

Its situation is most frequently over one parietal bone; exceptionally it is the site of the caput succedaneum.

**Prognosis.**—In the internal form the prognosis is grave if cerebral symptoms develop. The external variety, as a rule, terminates in subsidence of the tumor in about three months.

**Treatment.**—If the swelling grows it may be strapped firmly after shaving the head. If pus forms early incision is indicated. Otherwise no treatment is considered advisable by most authorities. The writer has practiced the evacuation of the blood within a few days after birth

by a small incision. The tumor must first be shaved and the strictest asepsis be observed. A firm antiseptic compress is applied and held in place with a roller bandage. When the incision has been delayed for one or two weeks a longer incision may be required owing to the presence of blood-clots. Should the hemorrhage persist after opening the tumor it may be controlled by pressure.

#### *Preputial Adhesion.*

In male children the adhesion of the foreskin to the glans which is usually physiological in newborn children, may cause irritability of the bladder and other reflex disturbances. In such cases the preputial orifice should be dilated very gently and the adhesion broken up till the foreskin can be fully retracted. Nicking the prepuce with scissors in the median line on the dorsum may be required to permit retraction. Drawing back the prepuce, it is liberated from the glans by the aid of a smooth, blunt, stiff probe; a dressing of vaselin or of bismuth powder together with daily retraction will prevent re-adhesion.

#### *Icterus.*

Icterus occurs in a large proportion of newborn infants. It begins from the first to the fifth day after birth, most frequently on the third or fourth. It is observed most frequently in premature and feeble infants and after difficult labor. There are two forms, the mild and the grave. Both are due to resorption of bile.

In the mild form the conjunctivæ and the urine are not stained. In the grave form the conjunctivæ and the urine are stained and the stools are clay-colored. This form may be due to general sepsis or to serious organic disease.



**Treatment.**—As a rule none is required. In persistent cases attention to the digestion, keeping the bowels open by enemata, or, if need be, by the use of a mild laxative, as sodium phosphate, combined if necessary with occasional small doses of calomel, constitute the treatment.

In persistent icterus with increasing discoloration, and especially with the presence of sepsis and high temperature treatment is generally futile.

### *Ophthalmia.*

**Cause.**—The cause is infection usually from the genital tract of the mother. The gonococcus of Neisser is the infecting organism in more than one-third. The ordinary pyogenic bacteria and the Loeffler bacillus are often the active agents. It generally begins on or before the third day.

**Prognosis.**—The prognosis for the sight is grave in the absence of timely treatment. Most serious is a mixed infection with gonococcus and streptococcus or with streptococcus and Loeffler's bacillus. A bacteriological diagnosis is important with relation to prognosis. In this country thirty-two per cent. of all cases of total blindness in asylums are said to be due to this cause. Almost without exception under skilfully conducted management the supuration is promptly controlled and the sight is not impaired permanently.

**Treatment.** *Prophylactic.*—The maternal passages should be disinfected before and during labor in case of gonorrhœal secretion. The child's eyes should be cleansed immediately after the head is born. Instil one or two drops of a two per cent. solution of nitrate of silver, or

a ten per cent. protargol solution into each conjunctival sac shortly after birth. The latter is now generally preferred. The prophylactic use of the silver solution is the rule in hospital practice. The eyes of every child are treated with solution within a few minutes after birth. A similar precaution may well be observed in private practice. It should never be omitted when the mother is known to be the subject of leucorrhœal discharges. When properly employed the immunity is practically absolute. Should the use of the silver solution be followed by much serous oozing the latter may be relieved promptly by a single application to the conjunctivæ of a one-grain solution of atropine, one drop in each eye.

*Curative.*—At the onset of the inflammation cold ice-water compresses, renewed every few minutes, are useful in the absence of corneal complications.

*Cleansing.*—Removal of the pus every hour or two by irrigating or bathing with a warm saturated boric-acid solution is essential.

*Silver Nitrate or Protargol Solution.*—After free discharge is established brush the conjunctival surfaces after cleansing once or twice daily with a two to four per cent. aqueous solution of nitrate of silver or a ten per cent. aqueous solution of protargol freshly made. This is continued till the discharge loses its purulent character. Frequent cleansing with the boric-acid solution must still be practiced till all discharge ceases. Anointing the edges of the lids with vaselin favors drainage by preventing the lids from becoming glued together. The nurse should be drilled in the method of manipulating.

As a rule the advice of an oculist should be had.<sup>1</sup>

### *Umbilical Infection.*

The cause is uncleanness in the care of the umbilical wound. The infecting organism is most frequently the streptococcus. The septic process may result in a mere local ulcer or in umbilical phlebitis and septicæmia. In the latter event the termination is fatal usually by convulsions. Pus may be present in the umbilical vessels from infection through the navel even when the wound has healed promptly. Cellulitis of the abdominal walls and peritonitis are frequently observed. Septic processes in remote organs are common complications.

**Treatment.**—In local sepsis frequent antiseptic cleansing of the wound surface and dressing with aristol, bismuth powder or iodoform and bismuth suffice. The peroxide of hydrogen is a good antiseptic for disinfecting the wound surface. It is non-poisonous and practically non-irritant. Inunctions of quinine and the use of stimulants by the stomach help to increase the resisting power. In systemic infection treatment is futile.

### *Tetanus Neonatorum.*

The disease begins toward the end of the first week. The cause is infection, generally of the navel, with the tetanus bacillus.

The *symptoms* are those of surgical tetanus. The termination is almost invariably fatal within two or three days.

<sup>1</sup> In New York State a midwife or nurse who may be cognizant of any inflammatory affection in the eyes of an infant under her care is required by law to report the fact in writing, within six hours, to the Health Officer, or to some legally qualified practitioner of medicine in the city, town or district in which the parents reside.

**Treatment.**—As far as possible all sources of peripheral irritation should be removed. Feeding is maintained through the nostrils, using pre-digested milk, or, this failing, by rectal injections. In feeding through the nostrils the food is poured from a special narrow pointed spoon. The drug treatment consists in the use of potassium bromide, gr. iv every two to four hours, or of chloral, grain j every hour, p. r. n. These remedies must be given by a stomach-tube or by a rectal tube. Sulphonal, gr. iij every two hours, by the rectum, has been used with success. The value of the serum treatment is still *sub judice*.

#### *Umbilical Hemorrhage.*

Umbilical hemorrhage may proceed from faulty ligation of the cord, syphilis, sepsis, acute fatty degeneration with hemoglobinuria or hemophilia. The hemorrhage usually begins within a week or a little more after birth. Eighty per cent. of the children die.

**Treatment.**—In simple cases re-ligate the cord and apply a compress, or lift the umbilicus, transfix with a harelip-pin and apply a figure-of-eight ligature. In cases dependent on a dyscrasia treatment is generally futile.

#### *Mastitis.*

Swelling of the breasts is frequently observed in newborn children during the first week. As a rule it calls for no treatment. If pus form, which is very rarely the case, it should be evacuated.

#### *A Bloody Genital Discharge.*

A bloody genital discharge is sometimes observed in female children the first few days after birth; no treatment is required.

## CHAPTER V.

### PATHOLOGY OF PREGNANCY.

#### DISEASES OF THE DECIDUÆ.

**Acute Endometritis.**—Acute endometritis may be present in the course of acute febrile disease. It is often attended with hemorrhage and frequently results in abortion.

**Chronic Diffuse Endometritis.**—The causation is not fully understood. The anatomical changes in the decidua are mainly hypertrophic. It occasionally gives rise to abortion.

**Catarrhal Endometritis.**—Catarrhal endometritis is attended with a discharge of watery mucus from the uterus—*hydrorrhœa gravidarum*; it is most common in the later months of pregnancy. Sometimes the fluid collects between the chorion and the decidua and is discharged in gushes. Rarely the uterus becomes excessively distended by the accumulated fluid. The inflammation affects most frequently the *vera*; it may also involve the *reflexa*. It is attended with hypertrophy of the connective tissue and of the glandular elements. Exceptionally it terminates in abortion or premature labor.

In this condition the hyperplasia of the uterine mucosa which is normal to the early months of pregnancy, is exaggerated and is continued to the later months of gestation. It affects all the elements of the decidua and re-

sults in a greatly increased thickness of this structure. Hemorrhage frequently occurs in the decidua. Cysts have been observed. The cause is a preëxisting endometritis which may be of the septic, syphilitic or gonorrhœal type.

When the process is rapidly developed it is attended with hemorrhages into the decidua or with partial separation of that structure ; abortion or premature labor is the rule.

Debility and anæmia frequently result from hydrorrhœa. The discharges are to be distinguished from liquor amnii, from urine and from leucorrhœal secretions.

**Treatment.**—The treatment is to be addressed mainly to the resulting debility and anæmia. The arsenate of iron or other hematinic and general tonics are indicated.

**Cystic Endometritis** is distinguished by the formation of retention cysts due to obstruction of the gland-ducts by proliferation of interglandular connective tissue. Here, too, there is hydrorrhœa.

**Polypoid Endometritis** is rarely met with. It is characterized by polypoid growths upon the ovular surface of the decidua, in addition to the lesions of simple diffuse endometritis. The pathological changes are generally limited to the decidua vera. Rarely, however, they involve the serotina. The placental villi may undergo hypertrophy or myxomatous degeneration. Death of the fœtus and abortion usually result.

#### ANOMALIES OF THE AMNION AND THE LIQUOR AMNII.

**Oligohydramnios.**—The quantity of amnial liquor at term is normally about two pints. Oligohydramnios is a deficiency of liquor amnii. Extreme scantiness of the

amniotic liquor may be attended with adhesions between the amnion and the foetus and with the formation of amniotic bands. Intra-uterine amputation of foetal extremities and other developmental faults sometimes result from these amniotic bands. Harelip, cleft palate, navel-cord hernia, and spina bifida are frequently produced by this agency. Oligohydramnios is one of the causes of club-foot.

**Hydramnios** or **Polyhydramnios** may be defined as an excess of liquor amnii over 4 pints. In extreme cases the quantity may reach 30 to 50 pints.

Polyhydramnios occurs much more frequently in multiparæ than in primiparæ. It is usually present to some degree in twin pregnancies. Excess of liquor amnii may exist in one foetal sac and deficiency in the other. Great excess of the amniotic liquor is often attended with malformation of the foetus. It begins most frequently in the latter half of pregnancy and is observed once in about three hundred pregnancies.

**Causes.**—Among the causes assigned are maternal anasarca, abnormal persistence of the vasa propria (a capillary network of the subplacental chorion immediately underlying the amnion, and which is normally present in the early months of gestation), excessive secretion of urine by the foetus, exudation of the foetal skin, amnionitis, decidual disease, deficient resorption of liquor amnii. Foetal syphilis is a possible cause.

**Diagnosis.**—The more important physical signs are excessive size and permanent tension of the uterine tumor, suprapubic oedema, preternatural mobility of the foetus. In extreme amniotic distention the cervix is obliterated. Hydramnios is distinguished from ascites, ovarian cyst and twins, by palpation and auscultation of the tumor and



by the history. The differential diagnosis will be found discussed under the topics referred to.

**Prognosis.**—The prognosis is unfavorable to the child, owing to premature birth, dropsical affections, malformations and malpresentation, which are common in hydramnios. The foetal mortality is 25 per cent. For the mother the prognosis is generally good.

**Treatment.**—In case of alarming symptoms from over-distention, puncture of the membranes, with care to guard against syncope from too rapid escape of the liquor amnii, is permissible. On the birth of the child precautions may be needed against post-partum hemorrhage. Special care must be taken to promote retraction of the uterus after delivery.

#### DISEASE OF THE CHORION.

**Cystic Degeneration of the Chorion, Vesicular Mole, Hydatidiform Mole,** may be defined as “an hypertrophy and myxomatous degeneration of the chorial villi, attended with the formation of cysts.” The cysts vary in size from that of a millet seed to a grape—they may reach the size of a hen’s egg. Each cyst springs from another and not from a common stalk. They may be many thousand in number and the total mass as large as the mother’s head. Very rarely the villi perforate the uterine wall, leading to rupture of the uterus and peritonitis. The cyst content is a clear watery fluid containing albumin and mucin. The degeneration begins most frequently in the very first weeks of gestation. In twin pregnancies one or both ova may be affected.

It is met with most frequently in women who have borne full term children, sometimes in more than one

pregnancy in the same individual. It occurs once in something more than two thousand pregnancies.

**Etiology.**—Of the etiology little is known. The cause apparently resides in the ovum. Endometritis, syphilis and absence or deficiency of allantoic vessels, commonly assigned as causes, probably have no part in the etiology.

**Diagnostic Signs.**—Signs of pregnancy :

Abdominal enlargement out of proportion to the stage of gestation ; the uterus is too large the first three months, later it is sometimes too small.

Absence of ballottement, of the foetal heart, of foetal parts and of foetal movement.

Uterus usually doughy.

Sero-sanguineous discharge.

Expulsion of cysts, rarely noted.

Detection of the cysts by direct exploration of the uterine cavity. The disease is rarely recognized till after the third month.

**Prognosis.**—The maternal mortality is 10 to 15 per cent. Immediate causes of death are hemorrhage, sepsis and rupture of the uterus. Except in rare cases of partial degeneration the embryo invariably dies and disappears by absorption. The degenerated ovum may be retained for many months ; usually it is expelled before the sixth.

**Treatment.**—If no evidence can be found that the foetus is living the uterus should be emptied. The cervix is to be dilated and the evacuation of the uterine cavity begun with the hand or dressing-forceps. This must be done cautiously, since the uterine wall is often extremely thin. Curettement is practiced after considerable retraction has taken place. The uterus is washed out with a hot, mild

antiseptic douche and its cavity swabbed with tincture of iodine. Ergot is given, if required, to make the uterus contract.

### ANOMALIES OF THE PLACENTA.

**Placenta Membranacea.**—A placenta membranacea is a broad, thin placenta with persistence of the villi over the entire surface of the chorion. Abnormal adhesion is common with this anomaly.

**Placenta Prævia.**—The placenta is prævia when its attachment encroaches upon that portion of the uterus which is subject to dilatation during the first stage of labor.

**Placenta Succenturiata.** *Subsidiary Placenta.*—This term is applied to a wholly or partially independent placental cotyledon. The anomaly is usually single, sometimes multiple.

**Cysts** of the placenta are of frequent occurrence. The cysts are small and are seated beneath the amnion. They are probably developed from the chorial villi.

**Syphilis.**—The syphilitic placenta is larger and paler than normal, and yellowish in patches. In syphilis of paternal origin the foetal structures of the placenta are affected; when the disease is of maternal origin the decidua is involved; in the tertiary stage gummata are present. Syphilis of the placenta is always dangerous, and may be fatal, to the foetus.

**Œdema** may be present in hydramnios, in occlusion of umbilical veins or in maternal anasarca.

**Apoplexy.**—Extravasations of blood into the placenta may occur at one or several points. Hemorrhages in the early months of pregnancy occur near the foetal surface, in the later months near the maternal surface of the placenta. The causes are placentitis, general infectious dis-

cases, nephritis, pelvic congestion, traumatism. Extensive effusions of blood result in the death of the embryo or foetus and consequent abortion or premature labor. Small extravasations are generally tolerated with no apparent ill-result. Small blood-collections may be found partially organized, or may become fatty or calcareous.

**Myxomatous Degeneration** usually involves only a part of the placenta. (See Vesicular Mole, page 210.)

**Fatty Degeneration** may result from endometritis, placental hemorrhage or chronic inflammation of the placenta. Death of the foetus may ensue.

**Placentitis** may affect the whole, rarely a portion only, of the placenta. Placental inflammation may result from endometritis existing at the time of conception, or from syphilis or acute sepsis. The normal placental structure is replaced by fibroid tissue. There are hypertrophy and sclerosis of the decidua. Abnormal adhesions of the placenta are attributed to this cause.

**Calcareous Degeneration** is common and is unimportant.

**White Infarcts** are very commonly observed in the placenta. They are dense whitish or yellowish masses varying in size from one to two or three centimeters in diameter. They are of no pathological importance when small and few in number. When numerous and extensive they may cause the death of the foetus. They have their origin in local degeneration of the decidua.

#### ANOMALIES OF THE UMBILICAL CORD.

**Length.**—Excessive length of cord may predispose to prolapse, to torsion, to knots, or to coils about the foetus and to obstruction in the funic vessels. A short cord

may lead to premature separation of the placenta during labor.

**Excessive Torsion** of the umbilical vessels may cause partial occlusion. It is sometimes accompanied with serous effusion into the peritoneal cavity of the foetus and with œdematous swelling of the cord. In most cases torsion of the cord itself is developed only after the death of the foetus.

**Knots** occur rarely. They result from the passage of the foetus through a loop of the cord. They are seldom firm enough to endanger the foetus.

**Hernia.**—Hernial protrusion of omentum or intestinal loops may take place into the cord. It results from imperfect closure of the abdominal walls at the umbilicus, and is usually accompanied with other errors of foetal development.

**Cysts** are frequently observed in the sheath of the cord. They are due to liquefaction of mucoid tissue or of blood extravasations.

**Coils** about the foetus, especially the neck, are of frequent occurrence. Sometimes an arm or a leg is thus encircled. Rarely is the circulation impeded either in the funis or the girdled member. Extensive coilings may give rise to the dangers of short cord.

Coiling of the cord about the neck of the child sometimes may be recognized during pregnancy by depressing the abdominal walls of the mother opposite the child's neck; the foetal pulse-rate is retarded when the cord is pressed upon.

**The Insertion** may be eccentric, marginal or velamentous. In the latter anomaly the vessels pass for a greater or less distance between the membranes to the edge of the

placenta. As the vessels are more or less separated and unprotected they are liable to be torn during labor. Such an accident almost surely results in the death of the child unless it is born promptly.

When the insertion of the cord is marginal the placenta is sometimes termed a battledore placenta.

## PATHOLOGY OF THE FŒTUS.

### ANOMALIES OF DEVELOPMENT.

The principal anomalies of foetal development are briefly the following:<sup>1</sup>

(a) **Hemiteria.**—Literally, half monstrosity. Under this head are included dwarfs and giants, microcephalus, sternal fissure, spina bifida, club-foot, supernumerary digits, double uterus, double vagina, supernumerary ribs, etc.

(b) **Heterotaxia.**—Under this head are included transposition of viscera, hernial protrusion, imperforate rectum, vagina, œsophagus, etc., persistent foramen ovale, persistent ductus venosus, persistent ductus arteriosus, etc., webbed fingers or toes, harelip, cleft palate, epispadias, hypospadias, hermaphroditism.

(c) **Teratism.** 1. *Ectromelic Monster.*—Having one or more aborted extremities.

2. *Symelic Monster.*—Having its lower limbs partly or wholly united.

3. *Celosomatic Monster.*—Having partial or complete eventration.

4. *Exencephalic Monster.*—In this anomaly the brain is malformed and protruding from the cranial cavity.

5. *Pseudencephalic Monster.*—Here the cranial vault and the larger part of the brain are absent.

<sup>1</sup> In part after Norris.

6. *Anencephalic Monster*.—The cranial vault and the entire brain are wanting.

7. *Cyclocephalic Monster*.—A monster in which the nose is wanting and the eyes are partially fused into one.

8. *Otocephalic Monster*.—The ears meet or are fused in the median line.

9. *Omphalositic Monster*.—This monster is one of twins which has a parasitic existence in utero. Its nourishment is derived from the companion foetus, and it is incapable of living independently after the cord is divided. The anomaly owes its origin to the fact that the circulation of one foetus has overpowered and reversed that of its companion.

10. *Double Monster*.—Two foetuses united.

**Varieties** :—(a) *Sternopagus*, joined at the sternum ; (b) *Ischiopagus*, joined at the pelvis ; (c) *Cephalopagus*, joined at the head ; (d) *Xiphopagus*, joined at the xiphoid cartilage.

*Syncephalic*.—The heads partly fused, the bodies separate.

*Monocephalic*.—The heads completely fused, the bodies separate.

*Synsomatic*.—The bodies are partially fused, the heads separate.

*Monosomatic*.—The bodies are wholly fused, heads separate.

*Double Parasitic Monster*.—One foetus is attached as a parasite to the other, or inserted or included in it.

### DISEASES OF THE FŒTUS.

The foetus is subject to many of the infectious and other general diseases of post-natal existence. Well-known ex-



amples are variola, typhoid fever, pneumonia, syphilis, scarlatina, measles, rachitis, valvular disease of the heart, serous effusions, etc.

### FCETAL DEATH.

**Diagnosis.**—*Signs* of foetal death are :

Recession of signs of pregnancy ;

Uterus doughy ;

Peptonuria ;

Acetonuria ;<sup>1</sup>

Cervical temperature not above the vaginal ;

Absence of foetal heart-tones ;

Absence of active foetal movements—examine by abdominal palpation and by the bimanual ;

Absence of the choc foetal ;

Looseness and crepitation of cranial bones.

Frequently the mother experiences periods of illness and a sense of weight in the abdomen.

In most cases of suspected death of the foetus repeated examinations will be required to decide the question. The diagnosis of death of the ovum is especially difficult in the early months of development before the period when in the living foetus the heart can be heard or active movements felt.

The recognized causes of intrauterine death, such as mechanical violence, maternal toxæmia or profound anæmia, syphilis, etc., should be sought for.

*Habitual death* of the foetus, in a great majority of cases, is the result of syphilis in one or both parents. The most important signs of foetal syphilis to be found by post-mortem dissection are osteochondritis, between the dia-

<sup>1</sup>Test for acetone : a 1 : 2,000 solution of fuchsine yields a violet color in presence of acetone.

physis and epiphysis of the long bones, especially at the lower end of the femur, enlargement of the liver, often to one-twelfth or even one-eighth the body-weight, enlargement of the spleen.

#### Changes in the Fœtus after Death in Utero.

The dead fœtus carried in utero undergoes either absorption, mummification, maceration or putrefaction.

*Absorption.*—This occurs usually when the fœtus dies in the first two months of gestation. The embryo in course of a few days after its death becomes liquefied and absorbed.

*Fleshy Mole.*—Sometimes when the ovum is carried in utero for a long period after the death and absorption of the embryo the uterine contents are reduced to a dense mass of placental structure and organized blood-clot known as a *fleshy mole*. This may be retained for many weeks or even months.

*Mummification* takes place only when the fœtus has died in the middle or later months of development. The soft structures become dried and shrunken and the skin assumes a yellowish-gray color. The placenta undergoes somewhat similar changes.

A fœtus *papyraceus* is a mummified twin fœtus which after death in utero has become flattened by the pressure of its living companion. The head in such cases is frequently pressed into the shape of a meniscus lens.

*Maceration.*—In maceration of the fœtus the tissues become softened and sometimes swollen and the abdomen is distended. The epidermis is exfoliated and the serous cavities contain blood and serum. The odor is sickening, but not putrefactive.

*Putrefaction* takes place only when the foetus is carried for a time in utero after the membranes have ruptured. The connective tissues become emphysematous, the abdomen is distended and the body emits a putrefactive odor. The uterus sometimes is tympanitic and the mother suffers more or less from septic absorption.

**Treatment in Fœtal Death.**—The uterus should be emptied immediately the diagnosis of foetal death can be positively established. The presence of a dead foetus in utero is always injurious to the health and may become dangerous to the life of the mother.

In the first three or four months of pregnancy the method to be pursued is the same as for the induction of abortion. In the later months labor is induced as in other cases of advanced pregnancy. The uterine cavity should be cleansed carefully after the labor.

### ABORTION.

**Definition.**—As commonly used *abortion* applies to expulsion of the ovum during the first three months of gestation, *miscarriage* to its expulsion during the next three months and *premature labor* to the birth of a viable foetus before term. Yet abortion and miscarriage are used interchangeably.

**Frequency.**—It is estimated that not far from 20 per cent. of pregnancies end in abortion. This estimate is doubtless too small if abortions from all causes are included. Owing to the influence of the menstrual moli-men spontaneous abortions occur most frequently at the end of the menstrual month. In a large proportion of cases they take place at the second month, and are comparatively infrequent after the third.

**Causes.**—In considering the etiology of abortion it must be borne in mind that the security of attachment between the ovum and the uterus differs greatly in different cases. Influences quite sufficient to bring about the expulsion of the ovum in one pregnancy may have no such effect in another.

The provoking causes of abortion may be grouped under two heads : (1) Those which act by first causing the death of the fœtus. In the great majority of cases abortion results from the death of the fœtus. (2) Those which act independently of the death of the fœtus.

1. Death of the fœtus may occur from : Malformation, disease, mechanical violence, maternal toxæmia or excessive anæmia, pathological conditions of the chorion, the amnion, the cord, the decidua.

2. Causes acting independently of the death of the fœtus are atrophy or hypertrophy of the endometrium, placenta prævia, oxytocics, reflex irritation of the uterus, *e. g.*, from mammary or from rectal stimuli, epileptiform convulsions from uræmic or other causes, carbon dioxide poisoning, placental apoplexies, pelvic adhesions, uterine myomata, cancer of the uterus, misplacement of the uterus, over-distention from hydramnios or from multiple pregnancy, direct interference, falls or blows, hyperæmia of the pelvic organs from circulatory obstruction in the lungs or liver, from valvular heart disease, from violent muscular exertion, or from sexual excesses, etc., resulting in hemorrhage into the placenta.

**Diagnosis.** *Symptoms.*—The symptoms of beginning abortion are : Hemorrhage, pelvic tenesmus, rhythmical uterine pains.

*Physical Signs.*—The physical signs are effacement of

the os internum, dilatation of the cervix and partial protrusion of the ovum from the uterine cavity.

The physical signs establish the diagnosis of inevitable abortion. They imply a degree of separation of the ovum from the lower uterine segment too great to permit the farther continuance of the gestation. Severe rhythmical pains with hemorrhage almost surely forebode the expulsion of the ovum. Not only should a thorough physical examination of the pelvic organs be made in every case of suspected abortion, but blood-clots and other material cast off from the genital passages should be inspected. Otherwise the ovum when expelled enveloped in a mass of coagulated blood may escape observation. Clots are best examined by breaking them up under water.

Abortion in the first weeks of gestation is not always easily distinguished from dysmenorrhœa or simple uterine hemorrhage. Here the diagnosis will depend mainly on the evidence of pregnancy as shown by the shape, size and consistence of the uterus, and on the presence of the foetal structures in the genital discharges. Free hemorrhage with expulsion of large blood-clots is significant of abortion.

Ectopic gestation is often mistaken for simple abortion.

**Prognosis.**—There is no mortality in properly conducted abortions, yet many deaths occur from mismanagement. The principal sources of danger are hemorrhage and septicæmia. Hemorrhage contributes to the fatal issue, though it is rarely the immediate cause of death. The danger of sepsis is especially imminent in incomplete abortion. The presence of necrotic material in the uterus is a serious menace to life. It is a potent cause of pelvic infection in cases which escape a fatal termination.

**Treatment.** (a) *Prophylaxis in Habitual Abortion.*—The preventive treatment of abortion is addressed chiefly to the cause.

Syphilis in one or both parents, retroversion of the uterus and endometritis are the most frequent causes of habitual abortion. Syphilis is treated as in other cases. It is not always possible to save the ovum by treatment begun after conception.

Retroversion is corrected and its recurrence is prevented by the use of a suitable pessary till after the third month.

Endometritis is best treated by curettage in the interval between pregnancies.

It is important to guard against overexertion, mechanical violence and the causes of pelvic congestion, especially at the menstrual dates. Rest in bed during the menstrual epochs and abstention from sexual intercourse should be enjoined till the critical period has passed.

(b) *Arrest of Threatened Abortion.*—Enforce absolute rest in the recumbent position. The patient should not be permitted to rise for any purpose till all symptoms of abortion have subsided. Uterine rest is maintained by the use of opium, gr. ij, or its equivalent, p. r. n. A four-grain pill of extract of viburnum prunifolium is useful as an adjunct, even as a substitute for opium.

Misplacements of the uterus must be corrected. Exclude vesicular degeneration of the chorion and death of the embryo or foetus, in either of which conditions the uterus should be evacuated.

(c) *Management of Actual Abortion.*—The general objects of treatment are the prevention of: (1) hemorrhage; (2) septicæmia.

Measures of controlling hemorrhage are : (1) Rest ; (2) firm cervical and vaginal tamponade ; (3) evacuation of the uterus.

Means for averting or controlling sepsis are : (1) The avoidance of preventable lacerations and abrasions ; (2) asepsis ; (3) timely evacuation of the uterus.

1. *Expectant Plan*.—Indications : Ovum but little detached, hemorrhage slight, sepsis absent.

*Method*.—Usually no interference is practised except such as is needed for cleanliness. An aseptic vaginal tampon may be used if required as a safeguard against hemorrhage. This plan failing after twenty-four hours empty the uterus with curette and forceps—sooner for cause.

*Method of Tamponade*.—Place the patient in the Sims position and expose the cervix with a Sims speculum. The material for the tampon may be aseptic cotton-wool, used wet enough to pack firmly, and in pledgets the size of a chicken's egg. Place a row of pledgets in the fornix, around the cervix, and build up from this until the vagina is full. Press the packing away from the urethra and base of the bladder to prevent vesical irritation. Hold it in place with a T-bandage.

Sterilized gauze in strips two and one-half inches wide and five yards long is a better material for the tampon than the cotton-wool. The simple aseptic packing must be renewed every twelve hours. A tampon impregnated with oxide of zinc may stand twenty-four hours. Mercurials should not be used in the tampon. The vagina should be irrigated at each renewal of the dressing.

2. *Radical Plan*.—Indications : Cervix dilated, the ovum detached or presenting or partially expelled, hemorrhage excessive, sepsis present or imminent.



*Manual Method.*—The abdomen, thighs, and vulva are thoroughly cleansed with soap, hot water and a soft brush, and the vagina if believed to be infected is douched and is scrubbed gently with a soft cheese-cloth sponge held in the grasp of a dressing forceps, and finally irrigated with the antiseptic solution for five minutes. The cervical canal is freed from mucus and disinfected.

Usually no anæsthetic will be required. The uterus is crowded down and fixed with one hand over the abdomen, and the cavity is evacuated with one or two fingers of the other hand, aseptically. The manual method is awkward, and difficult except the ovum is nearly or quite detached and the cervix well open ; even then it is inferior to the instrumental.

*Instrumental Method.*—Anæsthesia is necessary as a rule. The patient may be placed in the Sims or in the dorsal position, and the cervix exposed by means of a Sims speculum or other suitable retractor. The antiseptic preparation is carried out as already detailed. The anterior lip of the cervix is caught and held gently forward toward the pubic bones with a volsella. The uterine cavity, if septic, is douched with the antiseptic solution, otherwise with the salt solution ( $\frac{7}{10}$  per cent.), or with plain sterilized water. The ovum is detached with the curette and removed with a pair of long, straight, uterine dressing-forceps having a joint about two and a half inches from the distal end. Every part of the cavity is curetted thoroughly but lightly with a sharp curette and again douched. Care will be required to remove all the decidua from the cornua. A special small curette will be found useful for this purpose. The uterus after complete evacuation may be swabbed with tincture of

iodine if hemorrhage is not controlled by the curette. Only normal salt solution or plain sterilized water should be used in the uterus in the absence of septic material. Strong antiseptics leave a superficial necrotic layer which furnishes a favorable nidus for the growth of septic organisms. A relaxed uterus after abortion calls for ergot. If the secundines are necrotic the uterine cavity may be packed lightly with a strip of iodoform gauze an inch in width. The packing should be removed after twenty-four or thirty-six hours.

The presence of a peri- or parametritis does not forbid interference. It makes it rather the more imperative. Sepsis in the uterine cavity tends to perpetuate the peri-uterine inflammation, maintaining the supply of septic material.

**Incomplete Abortion.**—Continuous or irregular hemorrhage, sepsis or failure of involution after abortion is probable evidence that portions of the ovum have been retained. In such cases the uterine cavity should be disinfected, explored, and, if necessary, curetted.

**After-treatment of Abortion.**—The patient remains in bed for a week or more. The external genitals must be kept scrupulously clean. If the uterine cavity has been completely and aseptically evacuated after abortion, subsequent interference within the passages will not be required. The temperature and the character of the genital discharge are to be watched for several days. Before the case is finally dismissed the physician should assure himself of the condition of the pelvic organs by careful bimanual examination.

**PREMATURE LABOR.**

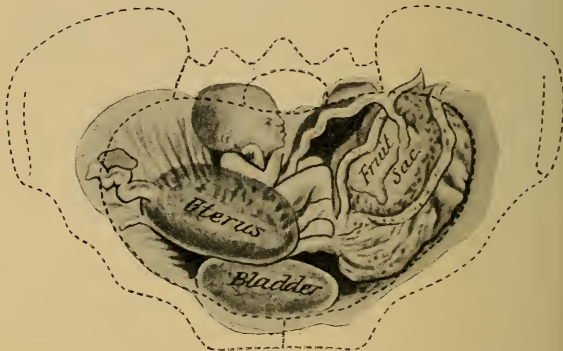
The causes of premature labor are essentially those of abortion. Its course and management do not differ in any important particular from those of labor at term.

**ECTOPIC GESTATION.**

**Definition.**—Pregnancy outside the uterine cavity.

**Varieties.** (a) *Tubal Pregnancy.*—In tubal pregnancy the impregnated ovum lodges and begins development in

FIG. 53.



Ectopic pregnancy ; rupture of fruit-sac into peritoneum. (After SCHAEFFER.)

the Fallopian tube. Practically all extra-uterine pregnancies are primarily tubal.

(b) *Abdominal Pregnancy.*—Sooner or later, if the development of the ovum is not interrupted, the tube ruptures, usually into the peritoneum, rarely into the broad ligament, because incapable of accommodating itself to the growth of the ovum. When after rupture of the tube

and the partial expulsion of its contents the ovum survives and grows in the abdominal cavity, either within or without the peritoneum, the pregnancy is said to be *abdominal*. Primary abdominal pregnancy does not occur.

(c) *Ovarian Pregnancy*.—The ovum is impregnated in the Graaffian follicle and developed in the ovary. Ovarian pregnancy, however, is so extremely rare that it will be dismissed with mere mention.

**Frequency**.—The frequency of extra-uterine pregnancy is variously estimated at from 1 in 313 to 1 in 1,200 pregnancies.

**Etiology**.—The etiology of ectopic pregnancy is still obscure. Among the causes which have been assigned are partial obstruction of the tube, sacculation of the tube and crippled peristalsis or denudation of ciliated epithelium from old catarrhal inflammation with consequent loss of propelling power. In the majority of cases according to Herzog, the cause is to be found in congenital anomalies.

**Clinical Course**.—Two classes of cases may be distinguished according to the location of the fruit-sac: A. Pregnancy in the free portion of the tube; B. Pregnancy in the intramural portion, or interstitial pregnancy.

A. *Pregnancy in the free portion of the tube* may have either of the following terminations:

1. The ovum may rupture and be expelled through the fimbriated extremity of the tube into the peritoneal cavity—tubal abortion.

2. The ovum may die without rupture or with partial rupture of the tube. In this event

- (a) It may form a mole or a hæmatosalpinx.

- (b) It may suppurate, forming a pyosalpinx.

(c) In early gestation it may be absorbed ; in more advanced pregnancy it may become mummified or be converted into adipocere or a lithopædion.

3. The tube may rupture into the peritoneum (usually before the eighth or twelfth week) with either of the following results :

(a) Very rarely the gestation continues as an abdominal pregnancy. In these cases the placenta retains its tubal attachment, the fœtus with its membranous envelope being expelled into the peritoneum.

(b) Hemorrhage occurs into the peritoneum, the mother dying from hemorrhage or peritonitis.

(c) The hemorrhage may be spontaneously arrested. The ovum may then be absorbed, may suppurate, or may remain with little change.

4. When the fruit sac is lodged in the inner two-thirds of the tube the tube may rupture into the broad ligament. Rupture between the folds of the broad ligament is not so common as formerly supposed. Intraligamentous rupture may terminate as follows :

(a) The placenta not being wholly detached, the ovum may continue to grow—*intraligamentous pregnancy*. This form of ectopic gestation may go to term. This is one form of abdominal pregnancy. Spurious labor occurs at term and the child dies.

(b) Death of the ovum and the formation of a hæmatoma may result.

(c) The ovum may die and suppurate. A suppurating ovum may be discharged piecemeal through the abdominal wall, the vagina, the bladder, the rectum ; may result in septicæmia and death.

(d) The ovum may die, and, if the development has

advanced to the later months, be carried indefinitely, with little or no alteration of structure, or be converted into a lithopædion or a mass of adipocere.

(c) Secondary rupture may take place into the peritoneal cavity.

4. Pregnancy in the outer third of the tube may become a *tubo-ovarian* or a *tubo-abdominal pregnancy*.

B. *Pregnancy in the intramural portion of the tube, tubo-uterine pregnancy, interstitial pregnancy.*

1. May terminate by the death of the ovum.

2. May terminate by expulsion of the ovum into the uterus.

3. May rupture into the peritoneal cavity, with death of the mother by hemorrhage. Rupture generally occurs before the sixth month.

4. May rupture into the broad ligament.

**Diagnostic Signs in the Early Months.** 1. *History.*—Antecedent sterility, signs of pregnancy. Frequently a long period of sterility has immediately preceded the pregnancy.

2. *Uterus.*—Displaced, according to the size and situation of the fruit-sac; enlarged, empty, cervix open.

3. *Tumor.*—Beside or behind or in front of the uterus, fluid, tense, tender, pulsating, rapidly growing.

Unfortunately, opportunity for physical examination is seldom afforded before rupture.

**Diagnostic Signs in the Later Months.**—The foetal movements are usually more distinct than in the utero-gestation;

The foetus is more accessible to palpation;

The foetal heart-tones are more intense;

Ballottement is obtainable in the fourth and fifth months;

Shrinkage of the tumor usually ensues upon the death of the foetus ;

The uterus can be differentiated from the tumor ;

Most reliable in the later months is evidence of pregnancy with a uterus but little developed and distinguishable from the tumor.

**Signs of Primary Rupture.**—Pelvic and abdominal pains, usually violent ;

Irregular genital hemorrhage ;

Symptoms of acute internal hemorrhage, with more or less collapse ;

*The pain* usually occurs in paroxysms. It is cramp-like in character and is referred to the seat of the fruit-sac. The final and more acute paroxysms are usually attended with *collapse* and with the signs of *internal hemorrhage*. Exceptionally the symptoms are not well marked.

The *genital hemorrhage* is irregular in occurrence and in amount. It is observed especially at the times of the painful paroxysms, and a more or less profuse discharge of blood commonly attends the rupture of the fruit-sac.

**Decidual Cast.**—In ectopic pregnancy, as in normal gestation, a decidua is developed from the uterine mucosa. At the termination of the pregnancy the decidual membrane is expelled entire or piecemeal.

This is distinguished by its histological characters from the products of intrauterine pregnancy and from the cast of endometritis. Under the microscope it differs from the former by the absence of evidence of implantation of chorial villi ; from the latter, according to certain authorities, by the presence of decidual cells, which are round or oval granular bodies, each containing a well-defined nucleus or



several nuclei, and having a diameter five to fifteen times that of a red blood-corpuscle.

The physical signs of pelvic hæmatocele or hæmatoma ;

Evidence of moderate peritonitis within two or three days after rupture.

In tubal rupture with much hemorrhage the clinical picture is unmistakable. It is not so plain when the blood-loss is small. Abortion and dysmenorrhœa sometimes simulate very closely ruptured tubal pregnancy and these must be excluded.

Intraperitoneal rupture is usually distinguished from extraperitoneal by more hemorrhage and by the physical signs of the free fluid in the pelvic peritoneum. The presence of free blood, and even of soft blood-clots in the peritoneal cavity, is difficult of recognition by the vaginal touch. When the blood effusion is encysted the condition cannot be distinguished from hæmatoma in the broad ligament. In intraperitoneal rupture a large, firm clot may be present in the tube, simulating a clot in the broad ligament.

Extraperitoneal rupture is characterized by the presence of a circumscribed and more or less firm tumor (blood-clot) in one broad ligament as revealed by the vaginal touch. The blood collection may dissect up the peritoneum and burrow behind the uterus. Examination by the rectum and, if necessary, under anæsthesia facilitates the diagnosis. A sacculated tube firmly adherent to the broad ligament, or encysted intraperitoneal blood may counterfeit intraligamentary rupture and may be mistaken for it even at operation.

Before opening the abdomen, if the diagnosis cannot be established, otherwise the uterine cavity may be explored

with the finger. It should not be forgotten that intra- and extrauterine pregnancy may coexist.

*Differential Diagnosis.*—Ovarian cyst, ovarian abscess, dermoid cyst, intraligamentous cyst, simple fluid accumulations in the tube—hydrosalpinx, pyosalpinx and hematosalpinx—and a retroverted and gravid uterus must be excluded.

Differentiation from pregnancy in the rudimentary horn of a uterus unicornis is difficult or impossible; but it is practically unnecessary, since the treatment is essentially the same in either condition. Left to themselves 80 per cent. of the latter class of cases terminate in rupture. As a rule no symptoms occur to arrest the attention of patient or physician before the uterus ruptures.

**Treatment Before Primary Rupture.**—1. *Celiotomy* and removal of the pregnant tube. In the abdominal operation the incision is made in the median line above the pubes large enough to admit the hand. The ovarian artery of the affected side is clamped immediately with catch-forceps close to the uterus, and again in the ovario-pelvic ligament just without the tube. Adhesions are broken up, the fruit-sac with the ovary and tube is lifted up and, by a crescentic incision, enough of the upper border of the broad ligament is cut away to carry with it the gestation-sac with the tube and ovary. The free ends of the divided artery and vein are now sought out and tied with fine catgut between the folds of the peritoneum. The clamps are removed and the edges of the peritoneum whipped together with a running suture of fine catgut.

2. *Vaginal Incision.*—Removal of the pregnant tube by the vaginal route is sometimes practicable. Either the anterior or the posterior incision may be adopted.

The technique is simpler in the latter. A half-inch incision is made transversely near the junction of the vagina with the uterus, usually 4 cm.,  $1\frac{1}{2}$  inch above the lower border of the cervix. The opening is then enlarged with the fingers. Tube and ovary are liberated, brought down into the vagina and tied off. The incision is closed with sutures. Operation by vaginal incision, however, is rarely to be recommended. The work can be done more safely and thoroughly by the abdomen.

3. *Fœticide by electricity* or by the injection of drugs into the fruit-sac is no longer practised.

**Treatment after Rupture into the Peritoneum.** *Immediate Cœliotomy.*—Method substantially as before rupture. The blood is removed from the peritoneal cavity and the peritoneum either sponged dry or irrigated with sterile normal salt solution—teaspoonful of salt to a quart of water. A few quarts of the saline solution may be left in the peritoneum to help refill the vessels. Vaginal drainage for one or two days is sometimes advisable.

In extreme anæmia and collapse a quarter grain of morphine may be given hypodermically a half hour before operating. A pint of normal salt solution should be injected behind each breast immediately before or during the operation if the woman has lost much blood.

If cœliotomy is refused the case must be trusted to rest with the use of sand-bags on the abdomen over the fruit-sac.

**Treatment after Rupture into the Broad Ligament.** *First Three Months.*—Limited effusions of blood do not necessarily require surgical intervention. Should the cyst-contents become septic the sac should be opened, either by the abdomen or by the vagina. In the abdom-

inal operation the sac is evacuated, as much of it is removed as possible, the bleeding stopped, the remnant of the sac closed and drained through the vagina. A large hæmatoma is generally best treated in like manner.

When the suppurating sac or small hematoma is accessible by the vagina it is best opened and drained from below.

If the ovum survives rupture of the tube into the broad ligament, it should be treated as a malignant growth by cœliotomy and extirpation of the fruit-sac. The life of the child in extrauterine pregnancy is of too little value to weigh against the interests of the mother.

*After the Third Month.*—The foetus may still be extra-peritoneal. Cœliotomy and removal, if possible, of the entire ovum are indicated once the diagnosis is established. When the foetus has been dead for two or three months the placental vessels will be found obliterated and the complete extirpation of the sac is generally possible. Tying the ovarian artery on either side of the fruit-sac usually controls the hemorrhage. Moderate bleeding after removal of the placenta may be taken care of by packing the bleeding cavity firmly with gauze, the lower end of the abdominal incision being left open for one or two days.

If the foetus is living it is not advisable usually to attempt the removal of the placenta. The sac may be stitched to the abdominal wall and the placenta left to separate, which usually occurs within a week or ten days. The recovery, however, is tedious, and attended with no little risk of septicæmia. When possible all or the larger portion of it should be removed after tying the arteries on both sides and ligating the base in sections.

*Secondary Rupture.*—After secondary rupture into the

peritoneum the treatment is the same as in primary intraperitoneal rupture.

**Treatment of Interstitial Pregnancy.**—When the diagnosis is possible the pregnancy may sometimes be terminated safely by emptying the fruit-sac through the uterine cavity. On intraperitoneal rupture coeliotomy is indicated as in pregnancy in the free portion of the tube. Supravaginal amputation of the uterus may also be required.

### PERNICIOUS VOMITING OF PREGNANCY.

**Etiology.**—The hyperemesis of pregnancy is to a greater or less extent a neurosis. In many instances it is a reflex disorder, dependent upon some anatomical lesion of the pelvic organs, such as uterine displacement, detention of the uterus in the pelvis by adhesions or other cause, decidual endometritis, induration of the cervix, erosion or inflammation of the cervix, perimetritis, yet it may occur independently of any discoverable pelvic disease. Lesions of other than the pelvic organs, and especially of the kidneys, may be complicating causes.

**Prognosis.**—In the majority of cases the nausea of pregnancy subsides by the third or fourth month, when the uterus rises out of the pelvis. In persistent uncontrollable vomiting the prognosis is grave.

**Treatment.** (*a*) *Dietetic Measures.*—Useful dietetic measures are: Breakfast in bed, followed by sleep; an ounce of sherry wine or a small cup of strong coffee before rising, a glass of cold Vichy or carbonated water several times daily; to this sodium bromide is a useful addition, one drachm to the siphon. Panopeptone or other predigested foods are often well borne. Other dietetic

measures, such as are practised in ordinary vomiting, may be of service. The longings of the patient frequently afford a reliable guide to the feeding.

Fasting for two or three days, sipping hot water at frequent intervals is useful.

*Rectal alimentation* must be relied on when stomach feeding is impossible. Beef blood, uncooked beef-juice, peptonized meat solutions, or predigested milk,  $\mathfrak{z}\text{iv}$ , q. 6 h., is a suitable food for the purpose. Five minims of deodorized tincture of opium may sometimes be added to the nutrient enemata with advantage. A large soft-rubber catheter or small rectal tube of similar material, with a funnel attached to the distal end, serves best for administering the food injections. The tube should be well lubricated and passed high up in the rectum with care to avoid irritating the bowel. The rectum should be washed out twice daily during rectal feeding.

(b) *General Therapy*.—Complete rest in bed for several days is an important aid in controlling the vomiting. Position with the shoulders low and hips elevated helps.

Useful drug measures are : Cocaine, gr.  $\frac{1}{8}$  to  $\frac{1}{4}$  repeated three or four times daily, or hourly until three or four doses are given ; cocaine spray to the pharynx or to the nares, 1 per cent. solution ; chloral, gr. xx to xxx, in solution by the rectum, two or three times daily, best given in milk ; the bromide of sodium in similar doses. Strychnine, gr.  $\frac{1}{40}$  to  $\frac{1}{30}$ , or tincture of nux vomica,  $\mathfrak{m}$  v in water before meals, is indicated in chronic gastric catarrh. Calomel, in small repeated doses, gr.  $\frac{1}{10}$ , q.  $\frac{1}{2}$  h., to 5 or 10 doses often does valuable service. Oxalate of cerium, gr. x, q. 2 h., when it can be retained, or subnitrate of bismuth in similar doses may be tried.



Ether spray to the epigastrium at the onset of each paroxysm is sometimes effective. An ice bag over the cervical vertebræ, or blister over the fourth or fifth dorsal vertebræ may help. Oxygen by inhalation has been used with success. A weak faradic current through the stomach sometimes relieves. Galvanism is thought to be of value. The anode is placed over the clavicle between the two branches of the sterno-cleido-mastoid muscle, the cathode over the umbilicus. The current strength should be 10 to 15 milliampères continued from fifteen to thirty minutes. Other remedies such as are useful in vomiting from other causes may be found of service. Combat toxæmia by stimulating the emunctories.

(c) *Local Measures*.—Cervical erosions should be touched with a twenty-grain solution of nitrate of silver every second day. Utero-displacements must be corrected. A vaginal gauze pack, renewed every two days, is often helpful. Sexual intercourse should be forbidden.

Galvanism of the uterus is sometimes useful. The anode is applied to the cervix, the cathode over the lower dorsal vertebræ. A current of 3 to 5 milliampères may be continued for five minutes. The sitting is repeated morning and evening.

A 10 per cent. cocaine solution freely applied over the portio vaginalis and within the cervix may relieve.

Copeman's method of dilatation of the cervix below the os internum, either alone or in combination with the foregoing cocaine method, is one of the most reliable measures for relieving the reflex disturbance. This treatment may result in abortion, and should be adopted only as a *dernier ressort*.



Induction of abortion is indicated when other means fail. It should not be too long withheld. It is justified only when the mother's life would be endangered seriously by longer continuance of the pregnancy, and then only with the concurrence of counsel.

*Methods of Inducing Abortion.*—Partial separation of the ovum with a sound and packing the cervix with iodoform gauze which is renewed every twelve to twenty-four hours are satisfactory methods. Either may be relied on or both may be combined. After the os internum is effaced the dilatation may be completed manually or instrumentally if the indication is urgent.

In experienced hands the rapid method of evacuating the uterus with the curette and a Keith forceps will be found best. The cervix is first dilated with a steel branched dilator till the curette passes readily. The major portion of the ovum is brought away with the forceps and the rest, including the decidua, with the curette. The uterus can easily be emptied in ten or fifteen minutes. The patient should be under an anæsthetic.

### PTYALISM.

Ptyalism, like the nausea of pregnancy, with which it is usually associated, is believed to be a reflex disorder. By certain authorities it is ascribed to a toxin. Troublesome salivation is comparatively rare.

*Treatment.*—Treatment is unsatisfactory. The following measures are sometimes of service: A saturated solution of potassium chlorate used several times hourly as a mouth wash; sulphate of atropine, gr.  $\frac{1}{100}$  once to three times daily per os; the bromides, gr. xxx to cxx daily; tincture of the chloride of iron, ℥v t. i. d. Salivation

is usually most relieved by treatment which subdues the nausea.

### ANÆMIA.

**Treatment.**—Blaud's pill, one or two t. i. d.; arsenate of iron gr.  $\frac{1}{20}$  to  $\frac{1}{10}$  t. i. d.; albuminate of iron in full doses; a solution of citrate of iron, gr. j hypodermically, are useful hæmatinics. A generous diet is essential.

### VARICES OF THE LOWER EXTREMITIES.

They are frequently present in the later months of pregnancy.

**Treatment.**—The treatment consists in support with bandages or elastic stockings. Much standing is obviously injurious.

### PRURITUS VULVÆ.

**Treatment.**—Place the patient in the Sims position, retract the posterior vaginal wall with a Sims speculum and dust the vaginal and vulvar surfaces with subnitrate of bismuth. Repeat daily or every two days. Fomentations to the itching parts with plain hot water or with a  $2\frac{1}{2}$  per cent. carbolic solution give temporary relief. Applications of cocaine hydrochlorate are useful. If the pruritus is of diabetic origin treatment must be addressed to the cause.

## CHAPTER VI.

### PATHOLOGY OF LABOR.

#### ANOMALIES OF THE MECHANISM.

##### A. ANOMALIES OF THE EXPELLING POWERS.

###### 1. Excess: Precipitate Labor.

**Cause.**—The cause of precipitate labor may be excessive activity of the expelling forces, or deficient resistance as in large pelvis or small head.

**Dangers.**—The dangers are for the most part insignificant. The principal risks to the mother are of lacerations, especially in primiparæ, shock and post-partum hemorrhage; to the child, asphyxia from the nearly continuous interruption of the utero-placental circulation, and the possible accidents of sudden and unexpected birth, such as falling on the floor, precipitation into a water closet, rupture of the cord.

**Treatment** consists in moderating the expelling forces by regulating the abdominal pressure, and, if required, by chloroform. The patient should be kept in bed from the onset of the pains.

###### 2. Deficiency: Prolonged Labor.

###### I. Prolonged First Stage. Tardy Dilatation.

###### (a) *Simple Inertia Uteri: Feeble Pains.*

**Causes** are emotional disturbance, full bladder or rectum, impaired muscular tone. Often the cause is obscure.

**Treatment.**—In the absence of danger to mother or child, the treatment should be expectant. Simple inertia uteri calls for no intervention so long as the membranes are unbroken and the patient gets sleep and nourishment enough. The bladder and rectum should be evacuated frequently, and other causes of inertia removed if possible.

Measures for accelerating the first stage, when intervention is required in the interests of one or both patients, are: Keeping the patient up and moving about, a hot sitz bath, a rectal injection of glycerin,  $\text{℥ss}$ , the alternate use of hot and cold compresses over the abdomen, strychnine, gr.  $\frac{1}{30}$  every four hours hypodermically, to arouse the nervous system, or quinine gr. v to x, moderate stimulation with wine, whiskey or other alcoholic stimulants, the faradic current from the upper sacral region to the posterior vaginal fornix, peeling up the membranes from the lower uterine segment, the passage of an aseptic bougie between the membranes and the uterine walls, artificial dilatation with the hand or with water-bags. Interference within the passages, however, should generally be withheld if possible.

(b) *Cramp-like Pains.*

The uterine contractions are painful but are inefficient, being more tonic than clonic. There is consequent failure of the normal changes in the lower segment and cervix which favor dilatation, even in the presence of apparently active pains.

**Causes** are neurotic influences, excessive uterine distention, as in hydramnios or twins, dry labor, and the consequent unequable pressure upon the cervix, malpresentation,

too firm adhesion of membranes at the lower uterine segment.

**Symptoms.**—The woman suffers excessive pain, yet the labor makes little or no progress. Mechanical obstruction must be excluded. The cervix is rigid, and if the membranes have ruptured the caput succedaneum is excessively developed.

**Dangers.**—Dangers are of exhaustion in proportion to the severity of the pain and the loss of sleep and nourishment; in dry labor, pressure-effects in both mother and child and septic infection. Atony of the uterus is likely to result. Exhaustion predisposes to a slow second stage.

**Treatment.**—Chloral, 5j in four doses of gr. xv each, at intervals of fifteen minutes, frequently does good service. Still more effective is opium, gr. j, once or twice repeated, if necessary, at intervals of an hour. These narcotics may do either of two things: they may regulate the action of the expelling powers by abolishing in part the inhibitory influence of pain, or by inducing sleep they may invigorate the natural forces.

The application of a ten per cent. solution of cocaine to the cervix is said to be followed by prompt dilatation.

Chloroform is very seldom permissible in this stage except as an aid to surgical intervention. Rupture of the membranes is indicated in marked hydramnios, peeling them up in undue adhesion.

In dry labor gradual manual dilatation should be practiced under anæsthesia. When time permits Barnes' bags may be used, but when efficiency and rapidity are demanded the hand is better. Gentle traction with forceps may be tried after dilatation is nearly complete.

Recourse may be had to multiple incisions of the cervix

or to Dührssen's incisions when immediate delivery is required. In the former method numerous shallow incisions are made in the lower border of the cervix with the scissors. The procedure is at once safe, simple and efficient. For the technique of Dührssen's incisions the reader is referred to the chapter on obstetric surgery. With a normal head the space gained is sufficient for immediate delivery. Dührssen's incisions are justifiable only as a last resort.

## II. Prolonged Second Stage.

**Causes.**—The causes are most of those which operate in slow first stage. In addition may be mentioned exhaustion, pendulous abdomen, excessive uterine retraction—retraction ring half way or more from the pubes to the navel—faulty action of the abdominal muscles.

**Symptoms.**—The evidence of inefficient pains is obvious. In neglected cases the temperature and pulse begin to rise and the vagina becomes hot and dry. Obstructed labor must be excluded.

**Dangers.**—Dangers to the mother are exhaustion and after-rupture of the membranes, pressure-effects, sepsis. Vesico-vaginal or recto-vaginal fistulæ may ensue from long-continued pressure of the head in the lower part of the birth-canal; in neglected cases extensive sloughing of the vaginal walls may result.

To the child the dangers are chiefly pressure-effects. The foetal mortality is large from intracranial hemorrhage due to asphyxia or occurring as the direct result of traumatism in instrumental delivery. Children who survive such injuries are not infrequently crippled in mind or body or both.

**Treatment.**—Obstructive causes are excluded by passing the hand into the uterus if necessary. The bladder and rectum should be evacuated. Uterine obliquity may be corrected by manual support, by posture or by the binder. Summon the help of the abdominal muscles. Give quinine, gr. x, strychnine, gr.  $\frac{1}{30}$  hypodermically, or alcoholic stimulants. Apply hot fomentations to the hypogastric or the sacral region. Put the patient in the semi-recumbent posture or squatting posture during the pains, or let her sit on the edge of the bed. Ahlfeld's birthstool may be tried. This consists of two stools so placed as to leave a triangular space between them opening to the front. The woman sits over the open space until the head is about to be born.

Use *expressio fœtus*, applying the pressure at the upper foetal pole or to the head only when the latter pole presents. Push aside intestinal loops and press downward in the axis of the inlet with one or both hands laid flat on the abdomen. The lithotomy position may help.

Ergot in full doses is dangerous to the child and even to the mother. In large doses it tends to cause a persistent uterine contraction. In doses of ten minims of the fluid extract, repeated hourly, it merely increases the force and frequency of the natural labor pains. Its use is seldom permissible, never except in the absence of obstruction and in minute doses such as to produce normal uterine contractions.

Forceps is indicated when the natural forces are clearly incompetent or longer delay would jeopardize the life of mother or child. As a rule intervention is called for when the head has been arrested a half-hour, after two hours in the second stage, especially if the head is low down



and there is no recession between the pains. Failure of recession between the pains is evidence that the normal tonicity of the soft parts has been destroyed by prolonged pressure of the foetal mass.

## B. ANOMALIES OF THE PASSAGES.

### I. Anomalies of the Hard Parts : Deformed Pelvis.

**Frequency.**—Contraction of some degree is present in from 10 to 15 per cent. of all parturients. Fortunately the higher grades of deformity are rare. Moderate contraction is by no means so. Among women born in this country contraction of the pelvis is very seldom met with. Moderate non-rachitic flattening, and general contraction, kyphotic and scoliotic deformity are most frequent.

**Gravity.**—The maternal and especially the foetal mortality are increased in proportion to the extent of deformity and the difficulty of delivery.

The chief dangers are those of prolonged labor intensified, to which are added those incident to operative intervention, malpresentation and malposition which occur more frequently than in normal pelvises, and to prolapsus funis, rupture of the uterus and post-partum hemorrhage.

The minor grades of deformity are dangerous for the most part to the child only. With early recognition and timely interference they usually present little difficulty.

**General Character of the Anomaly.**—Exceptionally the abnormality consists in faulty inclination only. In the majority of contracted pelvises the narrowing is at the brim and is most frequently an antero-posterior flattening. Obstruction may arise from old fractures, exostoses or other bony tumors.

## Description of Forms.

**Simple Flat Pelvis.**—This is the commonest variety of pelvic contraction. It consists simply of antero-posterior flattening. The intercrystal and the interspinal diameters have the same value as in the normal pelvis or may be slightly increased. Their relation is the same as in the normal pelvis or nearly so. The circumference may or may not be diminished. The true conjugate seldom falls below three inches. The other internal diameters are normal or nearly so.

In this form of pelvic anomaly the woman is usually of full stature and her general appearance presents no evidence of deformity.

**Influence of Flat Pelvis on the Mechanism of Labor.**—The head passes the brim with its long (occipito-frontal) diameter in the transverse of the pelvis and with the sagittal suture level or nearly so. Below the brim the head-movements are the same as in the normal pelvis.

**Flattened and Generally Contracted Pelvis.**—This pelvis is contracted in all its diameters, but especially in the conjugate at the brim. Its cause is arrest of development affecting the innominate bones and the lateral masses of the sacrum. The promontory of the sacrum is higher, and the diagonal conjugate therefore longer, than normal notwithstanding the shortening of the true conjugate.

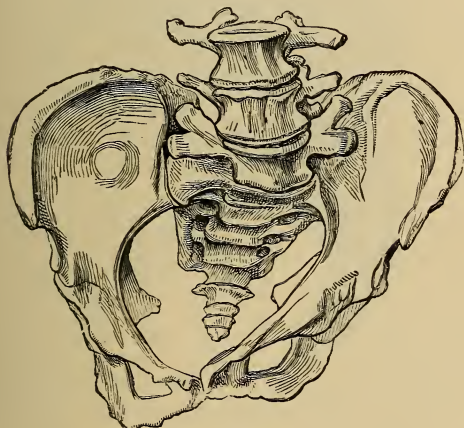
**Justo-minor Pelvis: Pelvis *Æquabiliter Justo-minor.***—This, as its name implies, is a generally contracted pelvis. Its diameters are not in all cases uniformly contracted. In occasional instances the narrowing is confined chiefly to the outlet. The justo-minor pelvis is most frequent in women of small stature. Yet its size bears no relation necessarily to the size of the woman's

body. This is a common form of contraction. It is due to arrest of development.

**Funnel-shaped Pelvis or Male Pelvis.**—The pelvis is narrowed at the outlet; the tubera ischiorum are approximated; the antero-posterior diameter at the outlet may be shortened. The subpubic angle is narrow. The sacrum is long and but little curved. The deformity is exceedingly rare.

**Kyphotic Pelvis.**—The upper end of the sacrum is tilted backward. The pelvic inclination is diminished.

FIG. 54.



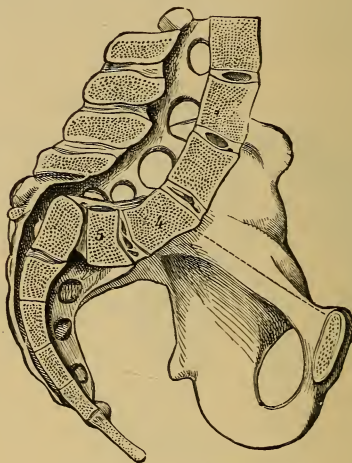
Naegle pelvis.

The transverse diameter is increased in the false pelvis, somewhat diminished at the inlet of the true pelvis, and the conjugate is lengthened. The pelvis is funnel-shaped; the ischial spines are strongly approximated. The sacrum

is narrowed, its longitudinal curvature diminished, its transverse curvature is increased, its lower end is displaced forward. The pubic arch is narrow, the symphysis is prominent. The cause of the deformity is kyphosis in the lumbo-sacral region.

**Naegele Oblique Pelvis: Ankylosed Obliquely Contracted Pelvis.**—There is complete or partial absence of one lateral mass of the sacrum, generally ankylosis of the

FIG. 55.



Section of spondylolisthetic pelvis.

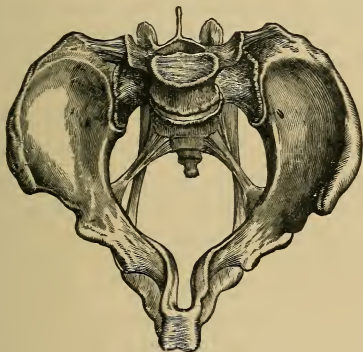
corresponding sacro-iliac joint and narrowness of the corresponding half of the pelvis; the opposite side is increased in size. The shape of the brim is an oblique oval; the symphysis is not opposite the promontory. The walls of the pelvic cavity converge below, the sacrum is

assymmetrical and the pubic arch narrower. This variety of deformity is very rare. (Fig. 54.)

**Ordinary Oblique-ovate Pelvis.**—The shape is similar to that of the Naegele pelvis, but the deformity is due to coxitis; the contraction is on the side opposite the crippled member.

**Roberts Pelvis.**—In the Roberts pelvis there is complete or partial absence of both lateral masses of the

FIG. 56.



Osteomalacic pelvis.

sacrum. The conjugate is somewhat diminished. The sub-pubic angle is narrow. The deformity is exceedingly rare.

**Spondylolisthetic Pelvis.**—The anomaly consists in a gliding forward of the last lumbar on the first sacral vertebra. The inferior surface of the former ultimately rests upon the anterior surface of the latter and becomes firmly united to it. Shortening of the antero-posterior diameter at the brim is extreme. Spondylolisthesis is very rarely met with. (Fig. 55.)

**Osteomalacic Pelvis.**—In osteomalacia the deformity arises from softening of the bones and consequent yielding in the direction of the existing pressures. The osteomalacic pelvis is, accordingly, sometimes termed the compressed pelvis. The pubic portion of the pelvis is beak-shaped. The sacrum is convex from above downward and from side to side. The bischial diameter is increased. (Fig. 56.)

This is one of the rarest forms of contraction.

**Narrowing of the Pelvis from Bony Tumors.**—Obstruction of this form comprises simple exostoses, callus and displacement of bones due to fracture.

#### Diagnosis of Pelvic Deformity.

*Clinical Data.*—Evidence of rachitis in infancy, such as history of tardy dentition and of sweats, pigeon breast, curvature of the tibia, of the spine, or other asymmetry of the body, large joints, very low stature are significant of probable deformity. Disability of one lower extremity dating from infancy is almost surely attended with pelvic contraction. A pendulous abdomen, presenting pole persistently above the excavation during labor, deformities in near relatives or a history of difficult labors should excite suspicion.

*Pelvimetry.*—The only means of exact diagnosis is the measurement of the pelvic diameters. Frequently the pelvis will be found contracted with no other evidence of abnormality than that afforded by pelvimetry. (See page 103 *et seq.*)

The pelvis should be carefully examined by palpation with reference to its shape and symmetry.

Most essential is the measurement of the external con-



jugate, the interspinal and the intercrystal diameters externally, and of the diagonal conjugate and the diameters of the outlet internally. The transverse and the oblique diameters at the brim internally are estimated with the hand in the passages. The shape and size of the sacrum, the presence or absence of bony tumors and the general conformation of the pelvis are determined by external and internal palpation. The pelvic inclination should also be estimated.

In most cases the value of the external conjugate decides the question whether or not the pelvis is ample, since in nearly all forms of narrow pelvis the conjugate is diminished. As a rule, with an external conjugate below 17.5 cm., 7 inches, the internal conjugate is small; external conjugate above 7 inches the internal conjugate is ample. Yet exceptionally the internal diameters of the brim may be normal when the diameter of Baudelocque is barely more than 16 cm.,  $6\frac{1}{4}$  inches, and on the other hand actual contraction may exist when the external conjugate measures 20 cm., 8 inches.

A pelvis with an external conjugate below  $6\frac{1}{4}$  inches is surely contracted; a pelvis with an external conjugate above 8 inches is almost surely ample; between these limits the question is left in doubt pending the internal examination.

Internally, a diagonal conjugate of 11 cm. in flat or of 11.5 cm. in generally contracted pelvises should be classed as abnormally short.

It must not be forgotten that the size of the foetal head is no less important a factor in the difficulty of delivery than is the capacity of the pelvis. The size of the head must, therefore, also be taken into account. The head



measurements cannot be so accurately determined as those of the pelvis. An approximate estimate is possible by measuring the accessible diameters of the head through the abdominal walls with a pelvimeter. It is also useful to try how far the head can be made to enter the brim by crowding it down with one hand over the lower part of the abdomen, while the fingers of the other hand passed internally estimate the depth of descent. When necessary for determining the size of the head during labor the half-hand should be introduced into the uterus.

In slight disproportion it is often impossible to determine definitely the prognosis for labor till the labor is well established.

#### Management of Labor in Flat Pelvis.

*Conjugate 9 cm.,  $3\frac{1}{2}$  inches, or more.*—1. The spontaneous delivery of a living child is generally possible. The membranes should be preserved by colpeurynter if required. Malpositions must be corrected. The bladder and the rectum should be emptied.

When nature fails delivery may be effected by :

2. Forceps, provided the head is engaged and the child living and viable. The forceps operation is here much more dangerous to mother and child than in the normal pelvis.

3. Podalic version, when the head is not engaged, the child is alive and viable and other conditions are favorable.

4. Craniotomy, as a rule, if the child is dead ; version or forceps may be chosen in easy extractions.

5. Premature labor. The induction of premature labor at the thirty-sixth or thirty-eighth week may be considered if the conditions are discovered in time.

*Conjugate, 7 to 9 cm.,  $2\frac{3}{4}$  to  $3\frac{1}{2}$  inches.*—When the fœtus is alive and viable Cæsarean section or symphysiotomy is indicated. Symphysiotomy is best restricted to conjugates between 7.5 cm., 3 inches, and 9 cm.,  $3\frac{1}{2}$  inches; when dead or non-viable podalic version or craniotomy is to be chosen.

Artificial premature labor at or soon after the end of the eighth calendar month may be considered when the contraction is recognized in time but the fœtal mortality is high—about 33 per cent.

*Conjugate, 7 cm.,  $2\frac{3}{4}$  inches or Less, Absolute Contraction.*—At term the Cæsarean section or the Porro operation is indicated. When the deformity is known in time the induction of abortion should be considered.

The choice of procedure, however, in narrow pelvis, must be determined by the relative, not alone by the actual size of the pelvis; the degree of disproportion between the head and the pelvis must decide. The size of the head may be estimated by the methods just detailed.

#### Management of Labor in Other Pelvic Deformities.

The method of delivery must depend upon the kind and degree of obstruction. At term version or forceps is competent in a small percentage of cases. The possibility of a living birth by induced labor should be considered when the condition is discovered in time.

Symphysiotomy is applicable when the conjugate is above three inches and there is but little contraction in other diameters. Craniotomy best serves the interests of the mother if the fœtus is dead or non-viable. In the higher grades or disproportion, the Cæsarean or the Porro operation is positively indicated and Cæsarean section may

be preferred to symphysiotomy except in the least degree of disproportion or when the condition of the mother is bad for abdominal section.

In excessive pelvic inclination the woman should be placed on the side to favor engagement of the head.

When the pelvic inclination is diminished the liability to injuries of the pelvic floor is greater than in normal conditions.

## II. Anomalies of the Soft Parts.

**Vulvar Atresia.**—Atresia may result from inflammatory adhesions of the labia majora, œdema vulvæ, thrombus, carcinoma, simple rigidity of the pelvic floor or rigidity of the hymen.

**Treatment.**—A large thrombus may require incision, evacuation of the blood-clots and packing the cavity. Nature or forceps is usually competent. A rigid hymen may call for single or multiple incisions. Other forms of rigidity, as a rule, may be trusted to forceps with, perhaps, episiotomy.

**Vaginal Atresia.**—Two varieties are recognized, congenital and acquired. The narrowing may be annular or may involve the whole length of the canal. In the annular variety multiple incisions and forceps will generally be required; in complete atresia the Cæsarean or Porro operation is the only resource.

**Cystocele.**—The treatment consists in replacing the prolapsed bladder-wall after catheterizing. Evacuation by the catheter being impossible, the bladder may be aspirated through the vaginal or the abdominal wall.

**Rectocele** is replaceable with the aid of the Sims or the genupectoral position. It is rare that delivery is complicated with prolapse of the vaginal walls.

**Rigidity of the Cervix** may arise from atrophic changes in aged primiparæ, from hypertrophy of the portio vaginalis or from cicatrices. The dilatation is to be left to nature except in the presence of danger to mother or child. Artificial measures, if required, are Barnes' bags, manual dilatation, multiple shallow incisions about the free border of the cervix, rarely deep cervical incisions. Good results have been claimed for a 10 per cent. solution of cocaine applied to the os uteri.

**Cancer of the Cervix.**—The induction of premature labor, cervical incisions through the healthy tissue with a thermocautery knife and extraction with forceps are sometimes possible. The passages should be irrigated repeatedly with an antiseptic solution during and after labor. Mercurials, however, must not be used.

Delivery with the aid of cervical incisions is advisable only when hysterectomy is impracticable. Generally Cæsarean section is required. It is best done before labor is spontaneously established. The entire uterus may be removed if the disease has not extended beyond the uterus and the condition of the mother permits.

When the disease is detected in the early months immediate panhysterectomy should be performed.

**Occlusion of the Os Externum.**—The os is reopened by incision from behind forward. If the depression corresponding to the os can be found with the finger, a small opening may be made with a knife and extended with scissors or stretched with the fingers or with a branched steel dilator.

**Tumors. Treatment.**—(a) *Vesical calculi* may be replaced, or, this being impossible, removed by vaginal lithotomy.

(b) *Vaginal Tumors*.—Removal, if practicable, is indicated, otherwise Cæsarean section or the Porro operation.

(c) *Uterine Tumors*.—Pedunculated tumors, when easily movable, may sometimes be pushed above the head with the aid of the genu-pectoral or the Trendelenburg position, or removed with écraseur or scissors. The Cæsarean or the Porro operation may be required.

(d) *Ovarian Cysts*.—Generally ovariectomy is indicated immediately on discovery of the tumor. During labor reposition should be tried. Cæsarean section is the only alternative when reposition fails. The tumor is removed at the same time.

#### Development Anomalies of the Uterus.

**Uterus Unicornis**.—One lateral half is absent; there is generally but one Fallopian tube. This malformation arises from failure of development in one of Müller's ducts. It is of special obstetric interest from the fact that the uterus sometimes has a rudimentary horn on the defective side in which pregnancy may occur. The condition is then very similar to tubal pregnancy. The rudimentary horn usually ruptures. Pregnancy in the developed horn of a uterus unicornis does not differ essentially from normal gestation.

**Uterus Didelphys**.—A bifid uterus; each lateral half forms a distinct organ, representing, however, but one-half of a uterus. The ducts of Müller, instead of fusing as they normally do to form the uterus, do not even come in contact with each other. The vagina may be single or double.

**Uterus Bicornis**.—The lateral halves are distinct above, united below—the upper part of the uterus is bifid. The

ducts of Müller are developed, but are not united in the parts corresponding to the upper portion of the uterus. The uterine cavity is sometimes divided wholly or partially by a median septum. The vagina may be single or double.

**Uterus Cordiformis.**—The fundus presents an antero-posterior median sulcus.

**Uterus Septus.**—The uterine cavity is divided, wholly or partially, into two lateral cavities by a median partition. When the septum extends through the length of the uterus the condition is termed uterus septus duplex. When the division is incomplete we have a uterus subseptus. Externally the organ betrays no evidence of the abnormality. In all double uteri pregnancy may occur in either or both lateral divisions. Pregnancy in either causes the development of a decidua in each.

### C. ANOMALIES OF THE PASSENGER.

#### Occipito-posterior Position.

In most cases occipito-posterior positions terminate as anterior positions by rotation either above the brim, in the cavity or at the vaginal outlet. Exceptionally the sinciput rotates to the pubes and the head is born with the face to the pubic arch. In this position the expelling forces act at a disadvantage; the long diameter of the head does not conform fully to the axis of the pelvis and labor is impeded. In persistent posterior positions of the occiput the head not infrequently becomes arrested by impaction in the pelvis. An impacted occipito-posterior position is one of the most formidable varieties of fetal dystocia.

**Causes.**—The causes of anterior rotation of the sinciput are : Imperfect flexion, bringing occiput and sinciput to the pelvic floor at about the same time ; defective resistance of the pelvic floor and consequent failure of the mechanism which normally shunts the occiput forward ; certain pelvic deformities, especially general contraction, oblique deformity and kyphotic pelvis, disturbing the normal mechanism.

**Diagnosis.** *Abdominal Signs.*—No dorsal plane ; small parts in middle section of the abdomen ; cephalic prominence marked ; heart-tones heard over lateral aspect of abdomen well toward the back ; anterior shoulder remote from the median line.

*Vaginal Signs.*—Large fontanelle easily accessible to the examining finger indicates either an occipito-posterior position or an imperfectly flexed anterior position. They are distinguished by the relative situation of the fontanelles and if necessary by palpating the ears with the hand in the vagina.

**Dangers.**—The dangers in persistent occipito-posterior position are : To the mother, exhaustion, pelvic floor lacerations, the risks of operative interference ; to the child, those of prolonged labor. The foetal mortality is 15 per cent. In a relatively large pelvis the malposition is practically unimportant.

**Treatment.** (a) *Above the Brim.*—Before rupture of the membranes the patient should lie in a lateral or latero-prone position on the side which the occiput confronts ; anterior rotation of the dorsum is thus often possible. The genupectoral position still more effectually helps the normal mechanism.

Rotation failing, after sufficient dilatation correct the



malposition by combined internal and external manipulation. One hand on the mother's abdomen pushes the anterior shoulder inward toward the median line ; fingers of the other passed into the uterus push the posterior shoulder of the foetus in the opposite direction. In this manner the child's dorsum, as well as the occiput, is brought to the front and there is no tendency to recurrence of the malposition. When the head alone is rotated it almost invariably reverts to its former position. By many authorities podalic version is preferred to the foregoing manœuvre.

(b) *In the Cavity*.—Anterior rotation of the occiput may be favored by keeping the patient upon the side to which the occiput looks, by upward pressure against the sinciput during the pains to promote flexion, sometimes by assisting rotation manually. If the head becomes arrested axis-traction forceps should be tried cautiously.

When simpler measures fail the occiput may be rotated to the front with forceps. With a good grasp of the head over the parietal bones, the head is rotated by carrying the handles of the forceps well over to one thigh. Care must be used to keep the axis of the blades strictly in the axis of the pelvis during the manipulation. The head should be rotated through only a small arc of a circle at each effort thus allowing time for the trunk to follow.

When the head is immovably fixed symphysiotomy may be considered.

(c) *At the vaginal outlet* it is almost always possible to rotate the occiput into anterior position by backward pressure with the fingers against the anterior temple, combined if necessary with forward pressure upon the occiput.

Only rarely must the head be delivered in the occipito-posterior position.

### Face Presentation.

**Frequency.**—The frequency of face presentation is about one in two hundred and fifty labors.

**Causes.**—The extension of the head probably is never primary ; it is developed during the labor. The causes are : Narrow pelvis, narrowing of the brim by prolapsed extremity, large child, enlargement of the neck or thorax, excessive uterine obliquity, pendulous abdomen, preternatural mobility of the foetus owing to small size or to excess of liquor amnii, impaction of the occiput in occipito-posterior position.

The preponderance of left mento-anterior positions is due to the right obliquity of the uterus.

**Mechanism.**—The occipito-mental diameter is in relation with the axis of the birth-canal, but that diameter is inverted, the head descending mental pole first. The values of the engaging diameters of the head are substantially the same as in vertex presentation. The difficulty of face births is due in the main to the fact that the thickness of the neck and a portion of the chest is added to the diameter of the face as the head descends, making a total diameter of  $6\frac{1}{2}$  inches.

#### *Positions :*

Left mento-anterior—L. M. A.

Right mento-anterior—R. M. A.

Right mento-posterior—R. M. P.

Left mento-posterior—L. M. P.

*Mechanism of Mento-anterior Positions : Head Movements.* 1. *Extension.*—This corresponds to flexion in

vertex births, bringing the occipito-mental diameter more nearly in relation with the axis of the pelvis.

2. *Rotation*.—Rotation of the chin under the pubic arch unlocks the difficulty of face birth. Failure here is more serious than in vertex presentation. The mechanism of rotation is entirely similar to that in vertex births (*mutatis mutandis*).

3. *Flexion* corresponds to extension in vertex presentation. The lower surface of the inferior maxilla rests on the margins of the ischio-pubic rami as pivotal points, and the head is expelled by a movement of flexion, face, forehead, vertex, and occiput sweeping in succession over the perineum.

4. *Restitution*.

5. *External Rotation*.—The explanation of these two movements is the same as in vertex births. The birth of the trunk follows the same mechanism as in vertex presentation.

*Mechanism of Mento-posterior Positions*.—In typical size of head and pelvis the birth of a persistent mento-posterior position is impossible, since it would necessitate the passage of a diameter of  $6\frac{1}{2}$  inches through the pelvis. Anterior rotation takes place in the majority of cases.

*Diagnosis. Abdominal Signs*.—Hour-glass shape of the uterus; cephalic tumor very round and filling one side of the pelvis only; cephalic prominence in relation with the fœtal dorsum, and generally on the same side of the median line with the breech; sulcus at the junction of the head and back; heart and small parts on the same side; inferior maxilla accessible to palpation.

*Vaginal Signs*.—Orbital ridges; nasal bones; malar bones; alveolar processes; chin.

**Prognosis.**—Mento-anterior face cases and mento-posterior that rotate terminate spontaneously, as a rule, with little more danger to mother or child than vertex births. The more formidable difficulties of face birth arise chiefly from its complications. Disproportion between head and pelvis, prolapse of foetal members and failure of the pains are met with more frequently than in normal presentation. The total mortality is about 6 per cent. of the mothers and 10 per cent. of the children. The face of the child at birth is usually much disfigured.

The principal dangers to the mother are exhaustion and pressure-necrosis; to the child, cerebral congestion from obstructed circulation in the veins of the neck. Rotation failing nearly all the children die.

**Treatment.**—Nature is competent in most mento-anterior positions and in most mento-posterior positions that rotate. In cases seen before engagement of the face, however, or when the head can be pushed above the brim with the aid of the lateral, the knee-chest or the Trendelenburg posture, as a rule the malpresentation should be corrected. In certain cases of posterior position it will be sufficient to reduce the position to an anterior one. The membranes should be preserved if possible until full dilatation.

*Mento-anterior Positions.*—In the absence of complications conversion into vertex, while permissible, is by no means imperative. These cases may generally be safely conducted as face births. Rotation is favored by keeping the patient on the side to which the chin points. Should the pains fail deliver with forceps. Since the conversion of a mento-anterior face case into a vertex presentation results in an occipito-posterior position, if this method be

chosen the operation should be supplemented by rotating the foetus into an anterior position.

Head relatively large, or cord or arm prolapsed, podalic version is generally demanded.

*Mento-posterior positions* not too firmly engaged should, as a rule, be converted into vertex presentations by one of the methods described below. Reduction of the position into a mento-anterior position may suffice in the absence of complications. This usually is possible with the hand in the uterus, the trunk being rotated at the same time with the head. In disproportion between head and pelvis and in prolapse of the cord or an arm the same rule applies as in mento-anterior positions.

When the face is too deeply engaged for reduction rotation may be favored by the lateral posture by promoting extension and by drawing the chin downward and forward during the pains.

Forceps in mento-posterior positions of the face is one of the most difficult and dangerous of instrumental deliveries, especially for the child, yet in skilled hands the use of forceps as a rotator is permissible. The technique is substantially the same, as in occipito-posterior position of the vertex.

Face immovably fixed, foetus living, deliver by symphysiotomy; foetus dead, by craniotomy.

#### *Methods for Converting Face into Vertex Presentation.*

1. *Schatz*.—This consists in pushing the breech forward (toward the feet) with one hand, the chest backward and upward with the other, by external manipulation, and finally crowding the foetus downward in the axis of the pelvis. It is applicable only before rupture of the

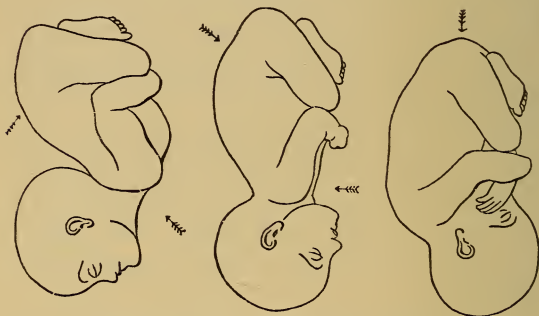
membranes and even then is not always practicable (Fig. 57).

2. *Baudelocque*.—(1) Flexing the head by pushing upward with the fingers first against the chin, then the fossæ caninæ, then the brow, with one hand internally, the external hand assists by forcing down the occiput.

(2) Hooking down the occiput with the internal hand the external hand pushes up the chest. Anæsthesia is generally required.

3. *Ziegenspeck*.—Baudelocque's first method may be combined with Schatz's, with the help of an assistant.

FIG. 57.



Schatz's method of reducing face to vertex presentation.

The genu-pectoral or the Trendelenburg position greatly facilitates the foregoing manipulations.

### Brow Presentation.

Brow presentation is a partial or semi-extension of the head. It is rarely met with, generally undergoing spontaneous conversion into vertex or face. By many obstetri-

cians this anomaly is treated not as a distinct presentation, but as a variety of face presentation.

The positions are those of face presentation.

**Causes.**—The causes are substantially the same as in face presentation.

**The Frequency** may be estimated at about 1 in 1,800 labors.

**Diagnosis. Abdominal Signs.**—The same as in face presentation but imperfectly developed.

**Vaginal Signs.**—Orbital ridges within touch on one side, bregma on the other side, of the presenting part.

**Prognosis.**—Delivery in persistent brow cases is impossible except with a relatively large pelvis. The maternal mortality is 1:10; the foetal 1:3.

**Treatment. (a) Conversion into Vertex.**—Before engagement convert into vertex by seizing the head, pushing it up and hooking down the occiput, with the hand in the vagina and with the aid of anæsthesia. During the manipulation the fundus is supported by firm pressure with the external hand. Pressure upon the occiput, applied through the abdominal wall, helps.

(b) *Conversion into face* by traction on the upper maxilla with the fingers. This is not admissible in mento-posterior positions.

(c) *Version* for rapid delivery, if indicated in the interest of mother or child and the head is not engaged or the uterus is not firmly contracted.

(d) *Symphysiotomy* in impacted and irreducible brow presentation if child is living and viable, if dead craniotomy.

In general the same principles apply as for the management of face births.



### Breech Presentation.

**Varieties.**—Three varieties of breech presentation are recognized according to the part of the pelvic extremity which presents—breech, knee and footling. The distinction is of no practical importance, so far as the mechanism is concerned. In certain cases, however, as will be seen, it affects the question of treatment.

**Frequency.**—Exclusive of premature labors, the frequency of breech presentation is about 1 in 60 births.

**Causes.**—The causes are : Narrow pelvis, tumors of the uterus, placenta prævia, hydrocephalus, multiple foetus and conditions favoring the mobility of the foetus, such as multiparity, prematurity, lax uterine walls, hydramnios, shape of the uterus possibly, small foetus.

**Mechanism.**—Usually the bisiliac diameter engages in one of the oblique diameters of the pelvis. We have, therefore, four

#### *Positions :*

Left sacro-anterior—L. S. A.

Right sacro-anterior—R. S. A.

Right sacro-posterior—R. S. P.

Left sacro-posterior—L. S. P.

Rotation in breech is not so pronounced as in head presentation. As the breech descends the posterior hip first lands upon the pelvic floor and first appears at the vulva. The shoulders rotate more or less completely. The head rotates as perfectly as in vertex births. In dorso-posterior positions the occiput, as a rule, comes eventually to the front. The nape of the neck resting against the pubic arch, the head is expelled by a movement of flexion around this as a pivot, the face, the forehead and the vertex successively sweeping over the perineum. Spon-

taneous expulsion of the after-coming head, however, is exceptional.

*In persistent dorso-posterior positions* the head is generally delivered by a movement of rotation about the posterior edge of the vulvar orifice, mental pole first as in anterior positions. If the chin catches upon the pelvic brim delivery is accomplished occiput first. In this method of expulsion the lower surface of the inferior maxilla pivots against the pubic bones, and occiput, vertex, forehead and face sweep in succession over posterior vulvar commissure.

**Diagnosis.** *Abdominal Signs.*—1. Fundal pole hard, globular, susceptible of ballottement, sulcus between it and the trunk ;

2. Lower pole irregular in shape, not so hard, in primiparæ above the excavation before labor.

When the head is in the lower uterine segment ballottement is possible only in multiparæ and with excess of liquor amnii ; even then it is imperfect. In primiparæ in the absence of pelvic contraction and of obstruction from tumors or other causes, the head, when it presents, is found in the excavation.

*Vaginal Signs.*—Glove-finger protrusion of the bag of waters ; obviously this can be present only after labor has been for some time established.

Absence of the hard globular head ;

Absence of fontanelles and sutures ;

Ischial tuberosity ;

Tip of the coccyx, anus, genitals, on a line bisecting the bischial line at a right angle.

Femora ;

Expulsion of meconium—not diagnostic ; it is sometimes observed in cephalic births.

Frequently both ischial tuberosities may be reached, and from them the femora be traced for a short distance.

Identify a foot or knee by its anatomical characters.

In differentiating between head and breech do not rely on a mere casual touch. Every accessible part of the presenting pole must be searched minutely, and with firm pressure if impacted in the excavation and its bony landmarks obscured by œdematous swelling of the overlying soft structures.

**Prognosis.** *To the Mother.*—The first stage of labor may be more tedious. The second stage is often more rapid. In artificial delivery laceration of the cervix occurs more frequently than in vertex births; in first labors at least laceration of the pelvic floor is the rule. The danger to life is not increased.

*To the Child.*—The mortality, when the delivery is left to nature, is one in three or four; with skilled management it is but little greater than in vertex births.

The cause of the foetal mortality is asphyxia from impeded blood-supply due to retraction of the uterus after the birth of the trunk, and from compression of the funis after the head engages. The foetal mortality is increased in dry labor.

Indications of danger to the child at the critical moment in breech delivery, are: funic pulse irregular and feeble, occasional gasping respiratory efforts, convulsive movements of the limbs.

**Treatment.** *Before Labor.*—External version is permissible if it can be done without violence. While conversion into vertex presentation is desirable, the indication for changing the presentation before labor is not sufficiently

urgent to justify the risk involved in a difficult external version.

*During Labor. (a) Delivery of the Trunk.*—The danger to the child arises chiefly from the difficulty of delivering the after-coming head before the child perishes from arrest of the utero-placental circulation by compression of the umbilical cord. Undelivered the child will almost surely die within five minutes after the head engages and the utero-placental circulation is cut off. The delivery of the after-coming head is facilitated by : (1) Ample dilatation of the passages ; (2) full flexion of the head, which also tends to maintain the flexion of the arms.

Promote 1 by preserving the membranes till they reach the pelvic floor and, as a rule, by a slow and gradual delivery of the breech ; maintain 2 by avoiding traction till the trunk is delivered, or, when traction is unavoidable, by external manipulation so applied by a skilled assistant as to keep the chin firmly pressed against the chest.

*Bringing Down a Foot.*—When the case is seen before the breech has engaged too firmly in the excavation one foot should be brought down. This is done as a precaution against arrest of the breech in the pelvis. The leg serves as a tractor should the expellent forces fail.

*(b) Delivery of the Arms and Head.*—Preliminaries. The patient, as a rule, should be under an anæsthetic. Have the forceps ready. See that a flannel or towel is in readiness for wrapping the child's body as soon as it is expelled, to help to prevent premature efforts at respiration. Watch the pulsation of the funis for warning of danger to the child. Pull the cord down and dispose it if possible in that part of the pelvis which offers the most room.

*Extraction of the Arms.* (a) *Arms Flexed.*—Bring them down with the hand passed along the child's abdomen.

(b) *Arms Extended.* 1. *Delivery of the First Arm.*—As soon as the shoulder-blade can be reached easily, grasp the feet and draw the trunk to the side opposite the occiput. Bring down the posterior arm first. Pass the free hand up along the child's back and slip one or two fingers over the shoulder and along the humerus to the elbow. Sweep the elbow in a circular direction across the face and down. Beware of applying the force at the middle of the humerus and of attempting to bring the arm straight down, lest the humerus be fractured or the shoulder-joint injured.

2. *Delivery of the Second Arm.*—Bring the child's trunk into the long axis of the mother's body, seize the trunk with both hands and push it up to release the head and extended arm from the grasp of the pelvic brim; rotate the trunk, if necessary, to carry the undelivered arm opposite the nearest sacro-iliac joint. Assist rotation by drawing the delivered arm gently across the child's back. Then, holding the trunk to the opposite side, bring down the second arm, sweeping the elbow inward across the face and downward as in case of the first arm. It is seldom that rotation of the head fails by twisting the trunk as above described. Should it do so from the fact that the head has been driven too far into the pelvis the manœuvre mentioned by Kehrer may be tried. This consists in pushing the occiput outward with the external hand while the face is swept inward with the arm by the internal hand.

*Extraction of the After-coming Head.* I. *Dorso-anterior Positions.*—Seizing the trunk again with both hands rotate

the head, if necessary, to bring the face opposite one of the sacro-iliac joints.

*Smellie-Veit (Mauriceau) Method.*—Two fingers of one hand are passed within the passages and held firmly against the fossæ caninæ or the inferior maxilla to maintain complete flexion. Two fingers of the other hand are hooked over the shoulders astride the neck. The child's

FIG. 58.



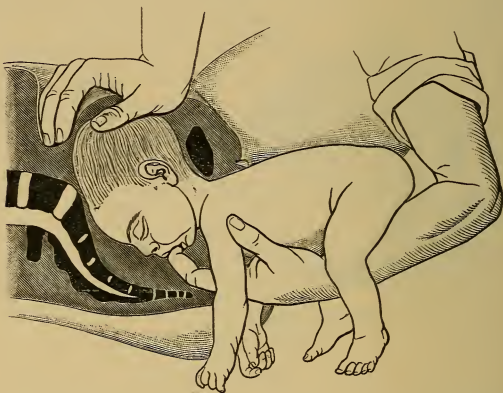
The Smellie-Veit method of extracting the after-coming head. (DÖDERLEIN.)

trunk lies on the operator's forearm. The head is delivered by traction. The natural mechanism must be observed, keeping the long diameter of the head in the oblique diameter of the pelvis till past the brim. As the chin approaches the fourchette a finger introduced into the mouth depresses the tongue for the admission of air.

*Expressio fœtus* by a skilled assistant is an important aid in bringing the head through the pelvis. (Fig. 58.)

*Wigand-Martin Method.*—Of manual manœuvres this is the most efficient when the operator must work without assistance. The technique is as follows: Two fingers of one hand are placed in the child's mouth or pressed against the fossæ caninæ to control the mechanism, es-

FIG. 59.



The Wigand-Martin method of delivering the after-coming head. (DÖDERLEIN.)

pecially to maintain full flexion. With the other hand the head is driven through the pelvis by powerful suprapubic pressure. (Fig. 59.)

*Forceps.*—An assistant seizing the child's feet holds its body well up over the mother's abdomen. The forceps is then applied to the head. This is the most reliable of all methods of extracting the after-coming head. Observing the normal mechanism and avoiding violence, the



danger of maternal injuries is no greater than in manual extraction.

II. *Dorso-posterior Positions*.—On expulsion of the body rotate the occiput to the front by gentle torsion of the trunk and with the aid of external pressure applied over the mother's abdomen by an assistant. Then deliver as in primary anterior positions. Rotation failing, deliver by traction and suprapubic pressure, carrying the trunk downward and backward over the perineum. Should the chin catch over the brim of the pelvis, deliver, occiput first, by traction upon the body directed upward and forward over the pubes, aided by suprapubic pressure or by the forceps.

*Nuchal Arm*.—Should the forearm of the fœtus be lodged behind the neck, rotate the body in the direction *from* the misplaced arm guarding against too much torsion of the neck. The rotation of the head may, if necessary, be assisted by external pressure. Sometimes the nuchal arm may best be dislodged with the hand in the passages. Having disengaged the arm, proceed as in ordinary cases.

*In Failure of the Powers at or above the Brim* one or both feet should be brought down, if this is possible without violence. With the aid of postural measures the breech may be dislodged from the brim after partial engagement.

When the legs are extended, carrying the feet high up in the uterus, the foot may be brought down as follows: Passing two or three fingers into the uterus between the thighs, one thigh is pressed outward; the knee is thus flexed and the foot brought down within reach of the operating hand.

*Impaction, or Failure of the Powers in the Cavity.*—Three methods are available for delivery, traction by finger, fillet, forceps.

The *finger* hooked in the groin is competent when only a moderate amount of force is required.

The *fillet*. A yard of strong muslin bandage or a soft handkerchief may be used as a fillet. It is oiled and knotted at one end. The knot is pushed up over the groin with one hand and hooked down on the opposite side of the thigh with the fingers of the other hand. Traction is then applied to the fillet with care to avoid doing violence to the structures of the groin by too great pressure.

In dorso-posterior positions the fillet is made to encircle the pelvis, the free ends depending between the thighs. One end is passed over each groin from without inward and the loop slipped up over the sacrum. Or the fillet may be passed over one groin and be held in place with one hand while traction is made with the other. The latter precaution is necessary owing to the danger of fracturing the femur should the fillet slip and traction be made upon the central portion of the shaft.

*Forceps.*—In cases not manageable by the finger or the fillet forceps may be applied to the breech. One blade is placed over the sacrum and ilium, the other over the posterior surface of the opposite thigh, or the blades are adjusted over the trochanters, especially in dorso-posterior positions, avoiding pressure upon the ilia. Moderate traction is made and assisted with *expressio fœtus*.

The cephalotribe, applied to the breech, may be used to advantage if the fœtus is dead.

**Transverse Presentation : Shoulder Presentation.**

A transverse presentation is one in which the long axis of the foetal ellipse lies across the long axis of the uterus. The presentation, however, is oblique rather than transverse. In a large proportion of cases cross presentations are spontaneously converted into longitudinal when labor begins. In persistent transverse presentation the shoulder, or sometimes the arm, becomes the presenting part after labor is established.

**Frequency.**—The frequency of shoulder presentations has been variously estimated, but may be fairly stated as 1 in 250.

**Causes.**—The causes of cross-birth, which is a partial inversion of the foetal axis, are practically the same as those of breech-birth or complete inversion. This anomaly is therefore observed most frequently in unusual mobility of the foetus, twin pregnancy, foetal tumor, myoma of the lower uterine segment, undue pelvic inclination, pelvic deformity, and low attachment of the placenta.

**Positions.**—Since the child's head may lie either to the right or the left of the mother, and its back may be turned anteriorly or posteriorly, there are four possible positions in cross-births, as follows :

Left scapulo-anterior—L. Sc. A.

Right scapulo-anterior—R. Sc. A.

Right scapulo-posterior—R. Sc. P.

Left scapulo-posterior—L. Sc. P.

It should be noted that these positions are named according to the direction of the presenting scapula. When the scapula looks to the left and front the position is a left scapulo-anterior, when to the right and front it is a right scapulo-anterior position, and so on.

**Diagnosis.** *Abdominal Signs.*—Absence of both foetal poles from the excavation after labor is established ;

Presence of the head in one or the other iliac fossa.

*Vaginal Signs.*—Glove-finger protrusion of the bag of waters ;

Presenting part smaller, more yielding and less distinctly rounded than the hard globular head ;

Especially significant is absence of any presenting part at the onset of labor ;

After labor is well established the presenting part is a small, rounded prominence ; it is distinguished from an ischial tuberosity by the absence of a companion ; from it run the humerus, the clavicle and the spine of the scapula in radiating lines ;

The neck is felt on one side of the presenting part, the ribs on the other ;

The axilla can be made out ;

The elbow is identified by the olecranon.

The position is determined by the location of the scapula to the right or left, anteriorly or posteriorly. The axilla and the elbow look toward the feet ; the thumb toward the head.

When an arm is prolapsed distinguish hand from foot, and the right from the left hand. Shake hands with the foetus ; the right hand of the examiner fits the right hand of the foetus, and *vice versa*.

**Prognosis.**—In persistent transverse presentations one in ten of the mothers and half the children die. The risks to the mother are from pressure-effects, exhaustion, sepsis, rupture of the uterus ; to the child, from pressure-effects, prolapsus funis.

*Spontaneous Delivery.*—Very rarely spontaneous delivery takes place in one of the following methods :

(a) *Spontaneous Version*.—The shoulder presentation is converted into a breech or into a vertex birth by the uterine expulsive efforts. Such a change of presentation is common at the beginning of labor. It occurs more frequently in multiparæ than in primiparæ, oftener with a living than with a dead child.

(b) *Spontaneous Evolution*.—The mechanism of spontaneous evolution is as follows: As the child is driven down by the uterine contractions the head rides over the symphysis and the anterior shoulder becomes fixed under the pubic arch. The other shoulder is forced down over the posterior wall of the pelvis and is expelled first. It is then followed by the trunk. The head is born last.

*Expulsion with trunk doubled on itself* may occur when disproportion between the size of the pelvis and foetus favors. It is almost surely fatal to the child.

**Treatment.** *Before Labor*.—Correct the malpresentation by external cephalic version. To retain apply an abdominal binder and lateral compresses.

*During Labor*.—Preserve the membranes; evacuate the bladder and rectum; note capacity of the pelvis, size of the child, situation of the retraction ring and the degree of thinning of the lower uterine segment. Perform version, cephalic or podalic, by the bipolar or the internal method, under anæsthesia. Reduction of the malpresentation is often possible with the aid of the genu-pectoral or the Trendelenburg position. In impacted and irreducible shoulder presentation decapitation will be required.

#### **Treatment of Complex Presentations.**

**Head and Hand**.—When possible replace the hand; this failing, deliver with forceps, placing the arm in the

unoccupied side of the pelvis, or, better, perform podalic version.

**Hand and Foot or Head, Hand and Foot.**—Extract by one or both feet.

**Nuchal Arm.**—The diagnosis is made by anæsthetizing the patient and introducing the hand into the passages.

In vertex presentation the arm is dislodged with the hand in the uterus by rotating the body *from* the nuchal arm. Rarely version will be necessary.

In head-last cases the nuchal arm is dislodged by seizing the delivered trunk with both hands and rotating the body from the misplaced arm. The other arm should first have been delivered. The reduction of the misplacement may be followed, if necessary, by introducing two fingers between the shoulder and the symphysis and bringing down the arm in the manner practised in ordinary breech extraction.

In complex presentation, if the fœtus is dead, delivery is best accomplished, as a rule, in the interest of the mother, by craniotomy.

## ANOMALIES OF FETAL DEVELOPMENT.

### Twins.

Relative situations of twins are : one above the other, one beside the other, one in front of the other.

**Diagnosis.** (*a*) *Abdominal Signs.*—Excessive size and tension of the uterine tumor ; permanent tension of the tumor, with very limited mobility of the contents, should suggest twins ;

Shape of the tumor ; excessive width, a longitudinal sulcus ; the latter, however, is not diagnostic ;

Suprapubic œdema; this is present also in simple hydramnios;

Multiplicity of small parts;

Two dorsal planes;

Three or four foetal poles;

One head in the excavation and one in the upper uterine segment;

One head in the excavation and one in the iliac fossa;

Distance from the pelvic pole to the fundal pole over 30.5 cm., 12 inches;

Two foetal heart-sounds of different rates;

Two foetal heart-sounds of the same rate, but in widely different situations and on opposite sides of the abdomen;

Heart tones above the umbilicus and head in the excavation.

(b) *Vaginal Signs*.—A rapidly successive presentation of a head and a breech;

Four extremities offering at the brim;

Two amniotic bags presenting.

**Management of Labor in Twin Births.**—The management of labor in twin births differs in nowise essentially from that of ordinary labor. The cord of the first child should be ligated on the placental as well as the foetal side, owing to the possible existence of a vascular communication between the two placentæ. Since the passages are dilated by the birth of the first child, the second birth, except when the first child is undersized, is usually rapid, or, if necessary, may safely be made so. The delivery of the second child, however, should be left to nature except for cause. The foetal heart should be watched. As the over-distention of the uterus exposes the woman to post-partum hemorrhage, extra care will be needed to



secure firm uterine retraction by manipulation and by the use of ergot.

#### **Interlocking Twins.**

This anomaly, which is exceedingly rare, presents two principal

**Varieties.**—(a) Both presentations cephalic, both heads offering, one impacted between the head and trunk of the other foetus.

(b) One presentation cephalic, one pelvic, the after-coming head of the breech birth being impacted between the head and trunk of the other foetus.

**Management.**—Disengage by a combined internal and external manipulation, with the aid of the knee-chest or the Trendelenburg position. The first child may be decapitated as a last resort.

#### **Double Monsters.**

Premature and spontaneous delivery is the rule. In most cases delivery will be facilitated by podalic version if the diagnosis is made in time to operate early in the labor. Resort should be had to embryotomy in difficult cases.

#### **Hydrocephalus.**

Hydrocephalus is attended with a serous effusion into the cranial cavity with consequent enlargement of the cranial vault. The effusion is usually found in the ventricles, very rarely in the arachnoid or subarachnoid cavity.

The quantity of fluid may be several pints. Spina bifida and other anomalies of development frequently co-exist. The etiology is obscure. Syphilis and alcoholism are among the causes assigned.

**Diagnosis.** (a) *Head-first Cases.*

*Abdominal Signs.*—The best diagnostic evidence is afforded by measurement of the head as determined with a pelvimeter through the abdominal walls or estimated by palpation. Mensuration of the head by this means may be impossible owing to hydramnios.

*Vaginal Signs.*—Size, elasticity and fluctuation of the cranial vault; excessive width of the sutures; the latter, however, is not peculiar to hydrocephalus;

Fontanelles preternaturally large;

Sometimes a supplementary fontanelle between the anterior and the posterior;

Unnatural prominence of the frontal and parietal bones.

The size of the head cannot be estimated by the usual method of vaginal examination, which explores only the presenting part. Elasticity and fluctuation are not always readily detected when the cranial vault is rendered tense by firm engagement in the pelvic brim. When in doubt the patient should be placed under an anæsthetic and the hand introduced into the uterus.

(b) *Head-last Cases.*—In one case in three the hydrocephalic foetus presents by the breech. The signs of hydrocephalus in breech birth are:

Body wasted;

Head arrested after the birth of the trunk;

The size of the head as determined by measurement or by palpation through the abdominal wall.

**Prognosis.** *Child.*—The mortality is over 80 per cent.; even if the child is born alive it is of feeble viability; nearly all die soon after birth.

*Mother.*—The mortality is estimated at 18 per cent., from exhaustion, rupture of the uterus, hemorrhage.

**Treatment.**—The delivery may be left to nature or may

be effected by version or perforation, according to the degree of obstruction. Version, however, is seldom available, owing to danger of uterine rupture. Aspiration of the cavity with a small trocar passed through a fontanelle or suture may often be substituted with advantage for craniotomy. The life of the child is not necessarily lost by drawing off the fluid. The forceps is not applicable; the grasp is insecure. When the head has been perforated the cephalotribe is the most efficient tractor.

In difficult head-last cases the head may be perforated or the spinal canal opened and the cranial cavity catheterized through it. The perforator can be passed safely beneath the skin, entering it over the neck.

*Serous effusions into other cavities*, if they cause marked dystocia, are to be evacuated by aspiration of the dropsical cavities or by free incision.

#### **Tumors.**

Hygroma, fibroma, lymphangioma, myoma, sacro-coccygeal teratoma, spina bifida, enlargement of abdominal viscera and other tumors are occasionally met with.

**Treatment.**—Delivery of the foetus intact being impossible, fluid tumors may be reduced by tapping or by incision, solid, by segmentation.

### **ANOMALIES OF LABOR ARISING FROM ACCIDENTS OR DISEASE.**

#### **Prolapsus Funis.**

In prolapsus funis a loop of the navel cords slips down in advance of the presenting part of the foetus. As the labor goes on the misplaced portion of the cord is com-

pressed between the part presenting and the walls of the birth canal, and without relief the foetus dies usually within five minutes from the interruption of the foeto-placental circulation.

**Frequency.**—Prolapse of the cord occurs once in about two hundred and fifty labors.

**Causes.**—Anything which prevents the presenting part from completely and continuously filling the lower uterine segment predisposes to prolapsus funis, *e. g.*:

Hydramnios ;

Deformed pelvis ;

Malpresentation (frequency in head presentation, 1 in 304 ; face, 1 in 32 ; pelvic, 1 in 21 ; shoulder, 1 in 12) ;

Complex presentations ;

Twins ;

Small foetus ;

Multiparity ;

Pendulous abdomen ;

Uterine myomata ;

Low placental insertion ;

Rupture of the membranes while the woman is standing.

Marginal insertion of the cord, or

Excessive length of the cord may favor prolapse.

**Diagnosis.**—The prolapsed cord may be found in the bag of waters, in the vagina, or protruding through the vulva. Before rupture of the membranes distinguish from fingers and toes by the anatomical characters of the latter. The foetal parts will usually be drawn up out of the way when touched. After rupture of the membranes the diagnosis presents no difficulty.

Prolapse of the cord must be distinguished from pro-

trusion of a loop of intestine following rupture of the uterus. In the latter there is more or less hemorrhage, the prolapsed loop is larger, the mesentery can be felt, and pulsation is absent. The prolapsed part of the cord should be examined for the funic pulse to learn whether the child is living. Absence of pulsation for fifteen minutes may be taken as evidence of the death of the foetus. Listen for the foetal heart over the abdomen.

**Prognosis.**—The prolapse itself entails no additional risk to the mother; the conditions which give rise to it and operative measures necessitated by it may do so.

The foetal mortality may be stated at 50 per cent. It is highest in vertex presentations and in first labors. The danger is much increased after the membranes rupture.

**Treatment.** *Before Rupture of the Membranes.*—Of first importance is the preservation of the membranes if still unbroken. It should be a rule to rupture them in no case intentionally without first examining for possible prolapse of the cord. Keep the patient in the lateral or latero-prone position. Place her on the side opposite that on which the cord came down in the hope that the displaced loop may return by its own weight. Push cord up between the pains, with care to avoid rupturing the membranes. Crowd the presenting part down and guard against recurrence of the displacement till the presenting part has firmly engaged. Listen at short intervals over the abdomen for the foetal heart.

*After Rupture of the Membranes.*—Reposit at once if the funic pulse can be felt; if the pulsation has ceased, but the heart-tones are still audible, push up the presenting pole and replace the cord after pulsation returns.

Do not subject the mother to the discomfort and the

risks of reposition till assured that the child is living and viable.

*Methods.* (a) *Manual Reposition.*—Place the patient in the latero-prone or the genu-pectoral or the Trendelenburg posture. Anæsthesia is generally necessary. Twist the prolapsed loop loosely into a rope and push it up anteriorly, operating between the pains. Much handling of the cord is dangerous to the child; it enfeebles the foetal heart. To retain, crowd the presenting pole firmly into the excavation and hold it there by manual pressure or with an abdominal binder. Let the patient lie in the latero-prone position, with the hips elevated, or in the Trendelenburg position. Examine through the vagina from time to time, lest the cord slip down again as the labor progresses.

Listen frequently for the strength and rate of the foetal pulse.

(b) *Instrumental Reposition.*—The aid of posture is essential, as in the manual method. An instrumental repositor is substituted for the hand. An English catheter, with a tape attached and loosely looped over the cord, makes an easily improvised and efficient repositor. After complete reposition the catheter may be left in the uterus. The instrument is armed with a stylet, which is withdrawn after replacing the cord. Measures for retention are to be used as in the manual method.

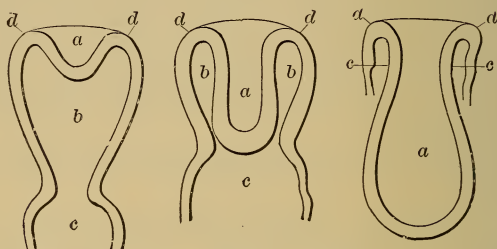
(c) *Forceps or Breech Extraction.*—Should all attempts at reduction and retention fail, sometimes the child may be saved by rapid delivery. This is possible in vertex presentation with forceps or by version; in breech cases, by the usual technique of breech extraction. The cord, meanwhile, should be disposed where it will receive the

least pressure, opposite the sacro-iliac joint in the side of the pelvis in which there is most room. It is sometimes best to resort to version primarily.

### Inversion of the Uterus.

The inversion may be complete or partial. It begins usually as a cup-shaped depression at the fundus. (Fig. 60.) In the vast majority of cases it occurs just before, rarely directly after, the expulsion of the placenta.

FIG. 60.



Three stages of inversion: 1. Cup-shaped depression of fundus. 2. Partial inversion. 3. Complete inversion. *a*, fundus uteri; *b b*, cavity; *c*, vagina; *d d*, mouth of inverted portion.

**Frequency.**—The frequency of puerperal inversion of the uterus may be estimated roughly at 1:100,000 to 1:150,000. In properly conducted labors the accident is well-nigh impossible.

**Etiology.**—Relaxation of the uterus in the third stage of labor is the primary cause. Unskilled pressure on the fundus, traction on the cord while the uterus is relaxed, or a fundal placental seat may contribute to the accident.

**Diagnosis.** *Symptoms.*—Complete inversion of the uterus is followed by shock, pain, hemorrhage and gener-



ally by vesical and rectal tenesmus. Exceptionally both the hemorrhage and the pain may be insignificant.

*Physical Examination.*—The bladder and the rectum should be empty. In partial inversion of the uterus a cup-like depression can be felt at the fundus by abdominal touch. Complete inversion is recognized by the absence of the usual abdominal tumor as made out by palpation or by abdomino-vaginal or abdomino-rectal examination, by the presence of a vaginal tumor and by the character of the tumor.

The inverted uterus is distinguished from a pedunculated fibroid by its special contractility, by its large pedicle and by greater pain and greater immobility on attempting torsion. In case of a polypus depending through the cervix a sound may be passed alongside the tumor into the uterine cavity, yet differentiation is sometimes difficult. It should be remembered that the placenta may still be adherent.

**Prognosis.**—Without prompt reposition the prognosis is extremely grave. The mortality, even in skilled hands, is one-fifth to one-third, from hemorrhage, shock, peritonitis, gangrene of the uterus, septicæmia.

**Treatment.**—*The preventive treatment* depends on the proper management of the placental stage of labor. Stimulate prompt and persistent retraction, meantime holding the anterior firmly against the posterior wall of the uterus by pressure over the abdomen.

*Methods of Reposition:*

(a) *Simple Cases.*—Immediately after inversion reduction is seldom difficult. The patient having been anæsthetized, the operator places one hand on the abdomen over the inverted uterus for counter-pressure, using the fingers at the

same time for dilatation of the cervical ring ; he cones the fingers of the other hand, and, passing them into the vagina, applies the finger-tips to the fundus. Sometimes the pressure is best made over the insertion of one Fallopian tube ; sometimes over the central portion of the fundus. The fundus once fairly indented complete reduction is easily effected. The force must be directed to one side of the sacral promontory.

Another method consists in pressing the fundus upward with the palm of the hand while two or more fingers indent the lateral wall of the uterus.

When the placenta is adherent replace all ; when it is partially detached separate and remove it before trying taxis.

(b) *Difficult Cases.*—Taxis may be tried with the aid of posture. This failing, recourse may be had to elastic pressure applied with a water-bag, alternated with taxis. Leave the bag in place for about eight hours, then remove it and repeat the taxis. Failing, apply the water-bag again for another eight hours. Rigorous precautions must be observed to prevent infection. Extreme measures are inadvisable during the puerperium, and attempts at reposition should be deferred for several weeks if not successful within twenty-four hours.

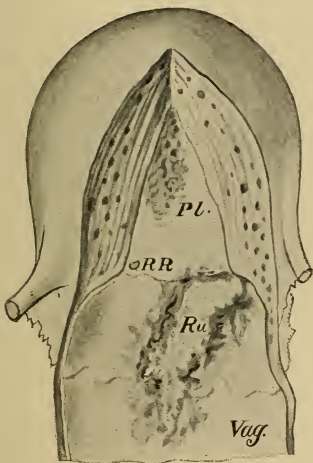
### RUPTURE OF THE UTERUS.

**Nature of the Accident.**—Usually the tear begins in the lower segment. It may take any direction and reach any extent within the limits of the organ. The vagina or the bladder may be involved. The portio vaginalis is sometimes torn off. Fissures of the cervix of greater or less depth occur in most labors.

The rupture is said to be complete when it extends from the uterine into the peritoneal cavity; otherwise it is incomplete.

Incomplete rupture not infrequently takes place into one of the broad ligaments. Spontaneous rupture occurs very seldom during pregnancy, most frequently toward the end of the first stage of labor. (Fig. 61.)

FIG. 61.



Rupture of the uterus. (SCHAEFFER.)

*Pl.* Placental site. *RR.* Retraction ring. *Ru.* Seat of rupture. *Vag.* Vagina.

**Frequency.**—This accident occurs in 1 in about 4,000 labors. It is less frequent in first than in subsequent births.

**Etiology.** (*a*) *Predisposing Causes.*—Local lesions of the uterine muscle; examples are carcinoma, myoma or

the cicatrix of an old laceration or of Cæsarean section not properly sutured. Pressure between the head and a sharp bony prominence, as the sacral promontory or an exostosis, may contribute to the accident. The chief predisposing cause is obstructed labor, with excessive thinning of the lower uterine segment.

(b) *Exciting Causes*.—Abuse of ergot and operative violence, such as forceps in an undilated os, version in a firmly contracted uterus, are prominent exciting causes.

**Diagnosis.**—*Danger signals* are :

Evidence of obstruction with violent uterine contractions ;

Tenseness of the round ligaments ;

Excessive retraction of the uterus as shown by high position of the retraction ring, more than half-way to the umbilicus ;

Preternatural pain and restlessness ;

Abdomen over-sensitive to pressure.

*Signs of Rupture :*

Sense of tearing ;

Abrupt cessation of labor pains, in complete rupture ;

Persistent uterine pain ;

Hemorrhage—external, retroperitoneal, intraperitoneal ;

Collapse in proportion to the amount of blood-loss ;

Presenting part absent or receding ;

No evidence of foetal life ;

Knuckle of intestine in the uterus ;

Uterus and the child forming separate tumors.

The diagnosis is confirmed on examining with the fingers in the uterus.

**Prognosis.**—In complete rupture the mortality for the mothers is 90 to 95 per cent., from hemorrhage, peritonitis, septicæmia. The foetal mortality is even greater from complete interruption of the utero-placental circulation.

**Treatment.**—1. *Preventive.*—The cause of obstruction should be removed if possible; malpositions should be corrected. In excessive retraction of the uterus immediate delivery is indicated, as a rule, even though it necessitate embryotomy.

2. *Curative. Incomplete Rupture.*—If the injury is confined to the upper uterine segment, the child and placenta being delivered, the treatment should be expectant. Hemorrhage is controlled by firm uterine contraction. Subperitoneal laceration of the cervix and lower uterine segment is attended with the formation of a more or less extensive hæmatoma. The blood-clot should be removed and the wound-cavity packed with iodoform gauze. Persistent arterial hemorrhage must be controlled by hæmodynamic suture. Mere oozing is arrested by the packing. The gauze is to be removed in two or three days and the wound-cavity kept clean by douching.

*Complete Rupture.* (a) *Drainage.*—When the foetus or the larger part of it is still in the uterus it should immediately be extracted by the natural passages. In vertex presentation delivery is best effected by perforation in the grasp of the cephalotribe or forceps. The placenta must be removed promptly. Should it have escaped into the peritoneum it may sometimes be drawn down to the uterine wound by the cord and extracted manually. Prolapsed intestines must be repositied. Drainage is then to be established as follows: A rubber tube one-half inch thick is folded, the limbs of the tube tied together, the

bright of the tube perforated in several places and passed through the uterine rent and about an inch beyond ; or a drain of aseptic wicking or gauze may be substituted for the tube. The uterus must be made to contract. The drain is removed in two or three days on cessation of much discharge.

(b) Cœliotomy should be done when the fœtus is wholly in the peritoneal cavity, has long been dead, when there has been much hemorrhage into the peritoneum, when the cervix is not dilatable, or the site of rupture not favorable for drainage. The peritoneum is cleansed by irrigation with the normal salt solution. The uterine lacerations are closed by deep suture.

Amputation of the uterus should be resorted to when necessary to avert sepsis ; especially is this advisable if the lacerations are extensive or the uterus is infected.

Vaginal hysterectomy may sometimes be substituted for abdominal.

*Treatment of Anæmia.*—If there is much loss of blood the anæmia is to be treated as in other cases, by bandaging the extremities, raising the foot of the bed, by hypodermic or intravenous and by rectal injections of the saline solution, by the administration of opium, strychnine and by other restorative measures. (See p. 298.)

## THE HEMORRHAGES.

### 1. Placenta Prævia.

**Definition.**—The placenta is said to be prævia when its site encroaches upon the zone of the uterus which undergoes dilatation in the first stage of labor.

*Degrees of Placenta Prævia.*—1. Partial—partially covering the zone of dilatation.

2. Complete—wholly covering the zone of dilatation ; full central implantation is rare.

**Frequency.**—Placenta prævia is met with in about one in one thousand labors. It occurs four to six times more frequently in multiparæ than in primiparæ.

In 143 cases collected by Chrobak, miscarriage occurred in 4 per cent., premature labor in 5 per cent., term delivery in 1 per cent. Hemorrhage began as a rule in six (lunar) months ; in 2.75 per cent. only three days before delivery. The placenta was central in 26 per cent., lateral in 1 per cent.

**Causes.**—Causes of misplaced placenta are conditions giving rise to tardy fixation of the ovum, permitting it to drop into the lower uterine segment ; *e. g.*, endometritis, enlargement of the uterus, relaxation of the uterus, abnormally low position of the tubal orifices.

The cause of hemorrhage during the labor is the separation of the lower margin of the placenta, which takes place as soon as canalization of the cervix begins. Hemorrhage before labor is explained by partial detachment of the misplaced placenta occurring from accidental causes.

The source of the bleeding is the uterus, and to a limited extent the placenta as well.

**Symptoms.**—Usually there are none in the early months. The first warning is a sudden outpour of blood of greater or less amount. The first hemorrhage is most frequently observed in the seventh or eighth month, rarely not till the onset of labor. Hemorrhage during pregnancy always demands immediate investigation to determine the source of the bleeding. This is doubly imperative in the later months.



In distinguishing from other hemorrhages it should be remembered that bleeding during labor in placenta prævia is most profuse in the intervals between the pains ;

That bleeding may proceed from a lesion of the venous network of the decidua vera, the situation of the placenta being normal ;

That hemorrhage persisting after rupture of the membranes is unfavorable to the diagnosis of placenta prævia.

**Physical Signs.** (*a*) *Abdominal*.—1. The location of the placenta may sometimes be made out by abdominal palpation. Beneath the placenta the foetal parts are obscure to the touch, elsewhere they are more distinctly felt. In most instances of anterior implantation the convex edge of the placenta can be traced as a resisting ring.

2. Mapping out the round ligaments by abdominal palpation, if they are found to run over the anterior surface of the uterine tumor, it may be assumed that the placental implantation is upon the posterior wall of the uterus ; if they run along the lateral margins of the uterus, the placental seat is on the anterior wall. When they are not found in either of these positions a prævial insertion is to be suspected.

(*b*) *Vaginal*.—Unusual development of the cervix, especially when the placenta prævia is complete ;

A cushiony mass between the presenting part of the foetus and the examining finger ;

The characteristic stringy feel of the detached surface of the placenta on examination through the cervical canal ; distinguish from blood-clots which are more friable. Bear in mind that the portion of placenta over the cervix may be only an adventitious cotyledon.

Bogginess of the cervix and lower segment of the uterus, commonly mentioned, is not characteristic;

In marginal placenta prævia the edge may be felt if detached.

**Prognosis.**—The maternal mortality in cases that go to the later weeks of pregnancy is one-fifth to one-fourth, including deaths from the sequelæ. Two-thirds of the children are lost.

The maternal mortality results from hemorrhage, shock, sepsis, and thrombotic affections; the foetal from asphyxia, the effect of the maternal hemorrhage on its blood-supply, prematurity and operative causes. The mortality for both mother and child obviously must vary, however, with the degree of hemorrhage. Maternal deaths from placenta prævia are extremely rare before the seventh month. The danger to life increases as gestation advances by reason of the increasing size of the blood vessels and the progressive loosening of the placental attachment. Post-partum hemorrhage is common.

Hemorrhage begins earlier in partial than in complete placenta prævia since the small portion of free placenta in the former slides more readily than does a placenta implanted all about the os.

It should be remembered that hemorrhage may be profuse with partial, or insignificant with complete, placenta prævia.

**Treatment.** (*a*) *Before Viability.*—Generally the treatment should be expectant. Partial or complete rest must be enjoined according to the amount of bleeding, and a general regimen prescribed very similar to that pursued for the arrest of threatened abortion or premature labor.

If the hemorrhage is copious, the placenta prævia complete, or the foetus dead, the uterus should be emptied.

(b) *After Viability*.—Induction of labor is indicated immediately the diagnosis is made, simple cases excepted.

*Management of Labor*.—The principal indication in the management of labor with placenta prævia is the control of hemorrhage. Hemorrhage controlled, wait, but remain with the patient until delivered.

*Nature* is equal to the control of the bleeding in rare cases of partial placenta prævia by extra-rapid delivery.

*Rupture of the Membranes* and the application of a firm abdominal binder may suffice in simple cases of partial placenta prævia. If uterine contractions are efficient or can be made so by stimulation the bleeding usually is controlled in the lesser degrees of vicious implantation. The presenting pole acts as a tampon.

*Forceps*.—If the cervix is sufficiently dilated forceps, with very moderate traction, may be tried in similar conditions, if required to hold the head in the lower uterine segment as a tampon.

*The vaginal tamponade* is especially valuable when there is little or no dilatation of the cervix. It is a competent measure as the chief reliance in the treatment of placenta prævia in general. The best material is sterilized gauze in strips; it may be used plain or impregnated with a non-toxic antiseptic such as oxide of zinc. To pack securely it must be wet. The vagina, if healthy, requires no antiseptic cleansing before placing the tamponade. The dressing is removed in six or eight hours. It may be renewed if the dilatation is not sufficient for delivery or resort may be had at once to bipolar version.

*Water-bags*.—A most efficient means of controlling the

hemorrhage is the dilating water-bag in the cervix, Barnes', McLean's, or the Champetier de Ribes. The latter, however, though most efficient mechanically, is difficult to render aseptic.

*Podalic version* is a measure of the greatest value for controlling the hemorrhage. It is especially indicated in case of much bleeding with little dilatation and before rupture of the membranes. With one or both feet down the foetus serves as a conical cervical plug. Bipolar version has the great advantage that it can be done as soon as one or two fingers can be passed through the cervix. The edge of the placenta is pushed aside and the fingers passed through the membranes. Even after sufficient dilatation it is seldom necessary to pass the entire hand into the uterus. After version the child may be extracted when the dilatation is complete. The delivery must be effected very slowly and with extreme care to avoid shock. As a rule it is better, if possible, to leave the expulsion to nature.

*Manual dilatation* and immediate extraction of the child, recently advocated by eminent authority, must be regarded as a questionable procedure for general adoption and doubly so when the woman is exsanguinated or much exhausted.

*Other Methods.*—Separation of the placenta from the lower uterine segment (Barnes) permits retraction of the part thus uncovered. The area of detachment should be not less than 11.5 cm.,  $4\frac{1}{2}$  inches, in diameter.

This procedure is not to be recommended except in simple cases of partial placenta prævia.

Complete separation and extraction of the placenta are applicable in case the child is dead or not yet viable. (Simpson.)

Extraction of the child by perforation of the placenta in central or nearly central implantation is permissible.

*Precautions.*—Avoid too precipitate and violent interference, especially if there has been much hemorrhage. It is largely responsible for the high death-rate of placenta prævia.

Guard especially against shock, infection and post-partum hemorrhage. Ergot should be given for several days after labor.

**Treatment of Acute Anæmia.**—Treatment is often required after the delivery to combat the effects of excessive blood-loss. The principal measures are: Elevation of the hips, bandaging the extremities—auto-transfusion—continued for a few hours, hot applications to the feet; opium, gr. ij p. r. n., or its equivalent; hypodermic injections of whiskey, fluid extract of digitalis, ℥j to ℥v, strychnine, gr.  $\frac{1}{80}$ ; trinitrin, gr.  $\frac{1}{50}$  to  $\frac{1}{25}$  repeated p. r. n. The injection of the normal salt solution ( $\frac{7}{10}$  of 1 per cent., approximately, gr. iij ad ʒj) into the rectum, into the cellular tissue between the scapulæ, into a vein or behind the mammary glands between the gland and pectoral fascia is a most valuable measure. A readily improvised apparatus for intra-venous infusion is made with a glass funnel, a few feet of rubber tubing and a canula of glass or metal. Apparatus and solution should be sterilized by boiling, and the latter be filtered. The salt solution should be slowly injected at the temperature of 100° F. Two or three pints may be used.

The post-mammary injection is simple, safe and scarcely inferior in efficiency to intra-venous infusion. For this or other subcutaneous injections a coarse aspirating needle attached to a fountain syringe may be used; all must be sterile.

The large bowel is kept filled with the physiological saline solution, with plain warm water, or with suitable nutrient enemata.

For the thirst a saline drink—*e. g.*, a weak solution of ammonium acetate—is recommended. Liquids by the stomach must be given in small quantities and often beginning with ʒj, at intervals of a minute or two. Plain hot water, brandy or whiskey and hot water are good restoratives. The use of nutrient fluids may be begun after a few hours.

## 2. Accidental Hemorrhage.

This term applies to bleeding resulting from the partial or complete separation of a normally seated placenta occurring in the later months of pregnancy or at the beginning of labor.

**Varieties.** (*a*) *Apparent*, in which the blood is discharged by the vagina.

(*b*) *Concealed*, in which the effused blood collects in the uterine cavity. Either of the following conditions may obtain :

1. Placenta detached at the center, the margin adherent ;
2. Placenta detached at one edge, partially lifting the membranes beyond the margin ;
3. Same as in 2, but overlying membranes ruptured and blood escaping into the amniotic sac ;
4. Separation of one edge of the placenta and of the adjacent membranes, but the lower segment of the uterus occluded by the foetal head.

**Causes.**—The loose attachment of the placenta, normal to the last weeks of pregnancy ;

Violent muscular effort ;

Violent uterine contractions ;

Short cord ;  
Excessive distention of uterus ;  
External violence, as blows or falls ;  
Disease of deciduæ ;  
Placental disease ;  
Nephritis ;  
Acute infectious diseases.

**Diagnosis.** *Apparent Variety.*—It is necessary to distinguish from rupture of the uterus and from placenta prævia. The former occurs later in labor and is attended with recession of the presenting part, with diminution of the uterine tumor and the development of a new abdominal tumor. The latter is readily recognized or excluded by a physical examination. Bleeding from low implantation of the placenta may easily be mistaken for accidental hemorrhage.

*Concealed Variety.*—The principal signs are :

Persistent tension of the uterus ;  
A node or boss on the uterine surface at the site of the retro-placental blood collection ;  
Atony of the uterus ;  
Uterine tumor boggy ;  
Fœtal parts obscured to palpation ;  
Continuous pain in certain cases from distention of the perimetrium ;  
Bloody liquor amnii—detected by pushing up the presenting part and allowing a portion of the liquor amnii to escape ;  
Fœtal heart-tones feeble and irregular.

Signs of internal hemorrhage, viz., collapse, pallor, surface cold, clammy, especially the extremities, excessive perspiration, respiration irregular, sighing, sobbing, yawn-



ing, pulse rapid, thready, compressible, thirst, jactitation, tinnitus aurium, dyspnœa, nausea, dimness of vision, syncope. It should be remembered that concealed may co-exist with an insignificant apparent hemorrhage.

**Prognosis.** *Apparent Variety.*—In this form the prognosis is not usually grave for the mother, but frequently is fatal to the child.

*Concealed Variety.*—For the mothers the mortality is 50 per cent. from shock due to hyperdistention of the uterus and operative causes, from blood-loss before and during labor, from post-partum hemorrhage and the sequelæ; the foetal death-rate is 90 per cent. or more, chiefly from asphyxia due to interruption of the utero-placental circulation. Prematurity is sometimes a contributing cause.

**Treatment.**—In the apparent variety if the bleeding is slight no intervention may be required. Generally in either variety the cervix should be dilated manually and the membranes be ruptured. Firm compression of the uterus is maintained by means of a binder, or by manual support applied by a skilled assistant, and ergot is given hypodermically. After full dilatation the delivery is rapidly completed by forceps or version, or in dead or non-viable foetus by embryotomy. Precautions should be taken against post-partum hemorrhage.

### Post-partum Hemorrhage.

**Definition.**—By post-partum hemorrhage is meant hemorrhage occurring shortly after the birth of the child and having its origin at the placental site. The accident can seldom happen in well-managed labors. Bleeding from laceration of the passages does not come within the meaning of this term in its technical sense. To distinguish ex-

cessive from the physiological flow it is necessary to remember that normally the blood-loss at the birth of the child varies from two or three ounces to a pint.

**Causes.**—Causes are imperfect ligation of the uterine vessels in consequence of inertia uteri from exhaustion, over-distention of the uterus, badly managed third stage, excessive use of chloroform, albuminuria, hemophilia, full bladder, rectum packed with fæces. The retention of blood coagula or of fragments of secundines tends to prevent full uterine retraction and closure of the vessels. Uterine neoplasms may have a like effect.

**Diagnosis.** *Danger Signals.*—A history of hemorrhage in previous labors; pulse over-rapid, above 100; imperfect retraction detected by palpation over the abdomen; presence of other recognized causes of hemorrhage, such as albuminuria, hemophilia, long-continued chloroform narcosis, etc.

*Signs.*—A sudden outpour of blood; no uterine globe; systemic effects of acute hemorrhage. (See page 300.)

It must not be forgotten that the absence of external bleeding does not, alone, forbid the diagnosis of hemorrhage. Excessive bloody flow with firm uterine contraction does not proceed from the uterine cavity; it comes from laceration of the cervix, vagina or vulva.

**Treatment.** *Prophylaxis.*—The preventive treatment must be addressed to the uterine retraction. The uterus should be watched, with the hand continuously on the abdomen, from the birth of the child and for at least a half-hour after the placenta is delivered. Friction may be used if required to provoke normal contractions. Fluid extract of ergot, ʒss, hypodermically, and repeated hourly, p. r. n., is a valuable prophylactic. It is especially in-

dicated after chloroform anæsthesia and in all conditions which predispose to hemorrhage. It is a wise precaution to give ergot on birth of the head when there is reason to fear post-partum hemorrhage. It is the abuse, not the proper use, of ergot that has brought it into disrepute in certain quarters.

**Remedial Measures.** (a) *Moderate Hemorrhage.*—Manipulation of the uterus, with one or both hands over the abdomen; conjoined manipulation with one hand over the abdomen and two or three fingers of the other hand in the posterior vaginal fornix forcibly anteflexing and compressing the uterus; fluid extract of ergot,  $\mathfrak{z}$ ss, subcutaneously; hot intrauterine douche, two or three gallons, at a temperature of  $120^{\circ}$  F.

(b) *Severe Hemorrhage.*—Compression and kneading of the uterus, with one hand in the cavity and the other on the abdomen; hot intrauterine injections of boiled water at a temperature between  $120^{\circ}$  and  $125^{\circ}$  F.; hand in the cavity of the uterus, raking the walls vigorously with the finger tips. The addition of 10 per cent. or more of acetic acid to the hot intrauterine douche adds materially to the styptic effect.

*The Uterine Tamponade.*—A most efficient measure for the control of severe post-partum hemorrhage is the uterine tamponade with sterilized gauze in strips about two inches wide. It should be reserved, however, as a last resort.

*Method.*—Place the patient in the lithotomy position, catch the cervix with a volsella and draw it well down. Carry the gauze into the cavity of the uterus with a uterine dressing forceps over the palmar surface of one hand as a guide. Lacking instruments the packing may be

placed with the fingers alone. Remove cautiously within twenty-four hours.

*Additional Measures* are the following: Application of the child to the breast as a reflex excito-motor; flagellation to the lower abdomen with a wet towel; faradism of the uterus, one electrode within the uterus and one over the abdomen or the upper sacral region, or both electrodes over the abdomen, one on either side of the uterus; curettage; swabbing the uterine cavity with tincture of iodine.

Hemorrhage from a lacerated cervix is best controlled by suture. The first stitch should be passed just above the angle of the tear. Vaginal hemorrhage should be arrested by suture. Anæmia is treated as in other cases.

#### **Secondary Post-partum Hemorrhage.**

**Definition.**—By secondary post-partum hemorrhage is understood hemorrhage from the placental site occurring within the post-partum month later than six hours after labor.

**Causes.**—The usual causes are retention of membranes, placental fragments or blood-clots, congestion of the uterus from misplacement or other causes, getting up too soon, violent emotion.

**Treatment.**—Keep the patient in bed and remove the causes if possible; correct uterine displacements. Hot vaginal douches, two or three gallons at a temperature of 120° F., are effective. These measures failing, curette the uterine cavity and pack with iodoform gauze; remove the packing in twelve or twenty-four hours.

#### **SEPARATION OF THE SYMPHYSIS PUBIS.**

Rarely rupture of the pubic symphysis may occur spontaneously, owing to the excessive relaxation of the joint

which sometimes develops in the later months of pregnancy. It is more frequently the result of unskillful use of forceps. The vagina and bladder are sometimes lacerated. Tears of the anterior soft parts may extend into the peritoneum.

**Diagnostic Signs.**—Mobility of the pubic bones upon each other; a sulcus between the bones; locomotion impeded on getting up. The mobility of the bones is readily made out by forcibly flexing and extending the thighs and by rotating one knee outward, patient on the back, or by requiring the patient to rock the body from side to side while standing.

**Treatment.**—Keeping the patient in bed with the use of a firm pelvic bandage maintained for four weeks if begun directly after labor, may generally be trusted to bring about union of the bones. Neglected cases may be treated by vivifying the joint-surfaces subcutaneously and applying the bandage for four weeks, the patient maintaining a recumbent position. Suturing the bones with silkworm-gut, catgut or silver wire is seldom advisable.

### ECLAMPSIA.

**Definition.**—Puerperal eclampsia is synonymous with puerperal convulsions. The convulsions are epileptiform in character, and are usually associated with albuminuria. They occur most frequently toward the close of pregnancy, during the labor, or in the first few days of the puerperium. Convulsions in childbed from hysteria, epilepsy or cerebral lesions, independent of the toxæmia of pregnancy, are not included under this term.

**Frequency.**—The frequency is variously estimated at about 1 in 500 cases of advanced gestation. It occurs

in about  $\frac{1}{5}$  in 5 of all cases of pregnancy nephritis. The disease, however, appears to be more prevalent at certain times and in certain localities. Nephritis, which is generally associated with eclampsia, is found in 5 per cent. of gravid women that go to term. Eclampsia is three times more frequent in primiparæ than in multiparæ and ten times more so in multiple than in single pregnancies.

**Etiology.**—The primal cause of the convulsions is a toxæmia with imperfect elimination by the kidneys and other emunctories. The precise nature of the poison is not yet known, but it is believed to be complex. Apparently the immediate cause of the convulsions is spasm of the arterioles and consequent anæmia of the brain, induced by the toxic material. The kidney complication may be nothing more than acute insufficiency, it may be a degenerative lesion, or acute parenchymatous nephritis. Sometimes acute supervenes upon chronic nephritis. In 368 cases examined post-mortem nephritis was present in 46 per cent.; in 54 per cent. there were degenerative processes; the latter doubtless were in part secondary to the eclamptic seizure (Prutz). Reflex irritation from the uterus is a potent coöperating factor in the eclamptic attack.

**Premonitory Symptoms and Signs :**

- Scantiness of urine ;
- Œdema, especially of the face ;
- Lassitude ;
- Headache, generally frontal, suboccipital rarely ;
- Nausea and other digestive derangements ;
- Contracted pupils ;
- Visual disturbances ;

Epigastric pain ;  
Albuminuria ;  
Deficiency of urea and of other urinary solids ;  
Tube-casts in the urine.

**Differential Diagnosis.**—Puerperal eclampsia is generally to be distinguished from hysteria and epileptic convulsions by the urinary examination and by the history.

**Clinical Phenomena.**—The attack is usually ushered in by the symptoms already referred to. At the onset of the convulsive paroxysm the eyes become fixed, apparently upon some distant object. Consciousness is abolished. Spasms begin in the facial muscles, then become general. The convulsion is at first tonic, then clonic. For a time the patient is asphyxiated owing to tonic spasm of the respiratory muscles. A few seconds later the breathing becomes stertorous. Froth oozes from the mouth and nostrils. The tongue is usually bitten during the convulsive seizure and the frothy discharge blood-stained.

The duration of the convulsion is usually one or two minutes. The interval between the attacks may be a few minutes or several hours.

Coma follows the eclamptic seizure, generally subsiding within a half hour. The coma, as a rule, deepens after each successive convulsion, owing to increasing oedema of the meninges or cerebral congestion. The pulse is usually rapid, often reaching 140 or more during the attacks. The temperature in different cases varies from normal or subnormal to 105° F. or more. The pyrexia is probably of toxic origin. Labor begins generally on the occurrence of convulsions, if not already established.

**Prognosis.**—The prognosis is the more grave the earlier the attack in pregnancy or labor. The danger increases



with the number of convulsions. Recovery is exceptional after fifteen or twenty seizures and seldom occurs after a temperature of  $105^{\circ}$  F. A small and feeble pulse is a bad prognostic. Profound coma, complete suppression of urine, and paralysis indicate an unfavorable prognosis. Impairment of the mental faculties sometimes follows. Psychoses result in about 6 per cent. of eclamptic women.

The toxæmia of pregnancy in women pregnant for the first time after forty years of age is almost invariably fatal if the pregnancy is allowed to go to the later months.

Pregnancy in primiparæ, the subjects of nephritis before conception, is uniformly fatal if not interrupted before term. (Tyson.)

The maternal mortality of eclampsia is from 25 to 35 per cent. from exhaustion, asphyxia, cerebral hemorrhage, œdema of the lungs. The percentage of deaths from eclampsia may be roughly stated as follows: convulsions beginning before labor, 39 per cent.; during labor, 29 per cent.; after labor, 19 per cent. The foetal death-rate is from 50 to 70 per cent., mainly from asphyxia. The toxic material is transmitted to the foetal blood and a certain proportion of children die after birth from this cause, usually by convulsions.

**Treatment.** *Prophylactic.*—A milk-diet limits the toxæmia. It should be given to the exclusion of all other food for a time. Farinaceous food, white meats and fish may be allowed to a limited extent as the symptoms improve.

Free catharsis by salines and diaphoresis by hot air baths, hot packs, and the use of sweet spirit of nitre render important service by supplementing the crippled elimination.

Water is essential for diuresis; it may be given hot or half-cold, plain or mildly alkaline; from four to eight pints may be taken daily, or a pint of normal salt solution may be injected behind each breast every four to six hours. Colonic irrigation with hot normal salt solution using a double canula is an efficient diuretic measure. Fifteen to twenty gallons may be used.

Hot fomentations and dry cups over the kidneys are useful.

Nitroglycerin in full doses is valuable, not only as a diuretic but as a direct anti-eclamptic.

Fluid extract of veratrum viride (Squibb), ℥iij to ℥vj t. i. d., or enough to hold the pulse below seventy, is an efficient prophylactic.

Chloral, ʒj to ʒij daily, or the bromide of sodium in similar doses is one of the most reliable agents for subduing the reflexes.

Iron is frequently indicated. Basham's mixture is a suitable preparation.

Marked uræmic symptoms or scanty urinary secretion not promptly relieved by dietetic and medicinal measures call for the induction of labor.

*Remedial.*—The principal reliance for controlling the convulsions is the combined use of chloroform inhalation, veratrum viride or nitroglycerin, catharsis, diaphoresis, active diuresis by hypodermoclysis, and the prompt evacuation of the uterus. For the veratrum chloral may sometimes be substituted. Morphine gr.  $\frac{1}{2}$  to  $1\frac{1}{2}$  hypodermically in combination with veratrum may replace veratrum alone when the pulse is feeble.

*Chloroform.*—Pending the action of other remedies place the patient at once under chloroform nearly or quite

to the surgical degree. Chloroform by inhalation is an almost certain anti-eclamptic. Its use is always imperative during operative interference. Yet prolonged chloroform narcosis is dangerous; one or two hours should usually be the limit.

*Veratrum Viride*.—Inject subcutaneously fluid extract of *veratrum viride* (Squibb) ℥x to ℥xx. If at the end of a half hour the pulse is not below 60, inject another ten minims. A convulsion is substantially impossible while the circulation is sufficiently under the influence of *veratrum* to hold the pulse-rate below 60. The patient must be required to maintain the recumbent posture while using the drug in large doses. Tumultuous action of the heart ensues immediately on rising. Collapse under *veratrum* is successfully combated by the use of morphine hypodermically, or by whiskey administered in similar manner or by the bowel.

*Veratrum*, by its effect as a vasomotor relaxant, not only controls convulsions but it acts as a diuretic and a diaphoretic.

Chloral is best given by the rectum in a teacupful of milk. The dose may be ℥ss hourly till ℥j or ℥ij have been given.

Catharsis.—For catharsis, calomel and salines, elaterium gr.  $\frac{1}{4}$  or croton oil ℥j to ℥ij, may be employed.

Diaphoresis.—The free action of the skin is to be maintained by the same measures as in the prophylactic treatment.

Diuresis.—Valuable measures for this purpose are hypodermoclysis, the injection of a pint of normal salt solution behind each breast every 4 hours and enteroclysis, irrigation of the bowel with a hot normal salt solution every 4

hours. Fifteen to twenty gallons may be used in this manner, using a double current canula, best a Kemp canula.

Other Measures.—Other anti-eclamptic measures of repute are: nitroglycerin, gr.  $\frac{1}{50}$  to  $\frac{1}{25}$  hypodermically; p. r. n., amyl nitrite,  $\mathcal{M}$  v by inhalation; the inhalation of oxygen; application of ice to the head and the carotids; in marked cyanosis venesection.

Prompt Evacuation of the Uterus.—Labor usually sets in on the occurrence of eclampsia. Measures are indicated to accelerate the labor if it has already begun, or to induce it if not spontaneously established. Convulsions cease in more than 80 per cent. of cases after delivery. Recourse may be had to manual dilatation of the cervix or to Dührssen's incision in extreme cases.

It should be stated that the induction of labor for the prevention of eclampsia is opposed by certain obstetric authorities. Its wisdom, however, either as a prophylactic or a curative measure can scarcely be questioned when other therapeutic measures have failed.

Precautions.—A cork or a folded napkin may be held between the patient's teeth during the convulsive attacks to prevent biting the tongue. If the tongue obstructs respiration it should be drawn forward. It is sometimes useful to remove the mucus from the throat with a swab held in the grasp of forceps.

Cardiac Supports.—If cardiac supports are called for, whiskey and strychnine are to be given p. r. n. Inhalations of oxygen are useful. The subcutaneous injection of the normal saline solution acts as a stimulant as well as an eliminant.

Restoratives.—During convalescence the anti-eclamptic

and the eliminant treatment are to be continued for two or three days, as required and later iron and general tonics are indicated as restoratives.

### DIABETES MELLITUS.

Sugar is to be found in the urine of women shortly before and for a few days after childbirth in about 50 per cent. of cases. It results from disturbance of the general nutrition. The form is most commonly glucose. Occasionally the glycosuria of this period is a mere lactosuria, due to resorption of milk.

True diabetes mellitus is a serious complication of labor and the puerperal state. It is dangerous to the mother and is usually fatal to the child. Fortunately, it is rarely encountered in child-bed.

### CARDIAC DISEASE.

Most valvular heart lesions are aggravated by the extra tax put upon the heart in the later months of gestation. Not infrequently they are the cause of abortion or of premature labor.

Advanced cardiac disease is a dangerous complication of labor. Engorgement of the right heart and œdema of the lungs often supervene. The danger is greatest at the close of the third stage, when a large volume of blood is abruptly thrown on the venous side from the uterine sinuses. Statistics show that multiple lesions are attended with the greatest mortality. Mitral incompetence or especially stenosis of the mitral orifice is almost equally fatal. Next in gravity is aortic incompetence.

**Treatment.**—In the later weeks of gestation and during labor the heart should be actively supported. Tincture

of strophanthus,  $\mathfrak{M}\text{v}$  q. v. h., or of digitalis,  $\mathfrak{M}\text{x}$ , guarded with trinitrin, gr.  $\frac{1}{100}$  t. i. d., should be given for several days, and continued during labor. Strychnine, gr.  $\frac{1}{40}$  to  $\frac{1}{30}$  t. i. d., is useful.

Laxatives should be given p. r. n. Resort may be had to venesection in extreme venous engorgement; the inhalation of amyl nitrite during the third stage is recommended; ether should be used in preference to chloroform as the anæsthetic, and that only during the severer pains of labor. The heart must be relieved as far as possible from the strain of labor by the use of artificial aids for delivery. Ergot should be omitted, since a little extra blood-loss is conservative. In asystole heart stimulants and venesection are indicated. Lactation is contraindicated.

## CHAPTER VII.

### PATHOLOGY OF THE PUERPERAL STATE.

#### PUERPERAL INSANITY.

THE mental disorder may begin during pregnancy or the puerperal period. In the puerperium the onset occurs most frequently at the end of about two weeks, seldom after five or six weeks. The psychical disorder very commonly takes the form of melancholia, sometimes of mania.

**Frequency.**—Puerperal insanity occurs in about 1 in 400 puerperal women.

**Causes.**—Causes most frequently assigned are hereditary predisposition, bad mental hygiene, violent emotional disturbance, eclampsia, anæmia, exhaustion, sepsis. Of these the predominating cause is sepsis. Recent investigations go to prove that the puerperal psychoses originate most frequently in some form of toxæmia, especially in septic infection.

**Prognosis.**—The prognosis is better in the maniacal than in the melancholic form. It is not so good in lactational insanity as in cases beginning during pregnancy. A marked heredity is unfavorable.

The mortality does not exceed 8 or 9 per cent. Nearly 70 per cent. recover their reason.

**Treatment.**—If proper nursing can be had home treatment is, in mild cases at least, better than the asylum.



Look to the mental and physical hygiene. In the puerperal forms suspend nursing. Iron, pil. Blaud, one or two t. i. d., or arsenate of iron, gr.  $\frac{1}{10}$  t. i. d., is indicated in anæmia. The hypodermic injection of the hydrobromate of hyoscine, in doses of gr.  $\frac{1}{100}$  to gr.  $\frac{1}{25}$  two or three times daily, is a useful sedative in maniacal forms. Chloral, the bromides, chloramid or paraldehyd may be required as sedatives and hypnotics. Chloral, however, is contraindicated in marked anæmia. Morphine, gr.  $\frac{1}{8}$ , is sometimes permissible. Intestinal fermentation and septic infection are to be treated as in other cases.

### GALACTORRHEA.

This term applies to excessive secretion of milk which persists after weaning. The quantity may reach several quarts daily. The quality is thin and watery. The disease may affect one or both breasts. It often results in serious impairment of the general health.

**Treatment.**—Treatment consists in the use of a compression breast-binder, and restriction of liquids. Potassium iodide, gr. v t. i. d., may be tried. The topical use of oleate of atropia may be of service. Coffee diminishes the secretion. The free use of purgatives is essential. Tonics and general restorative measures are especially indicated.

### MASTITIS.

**Frequency.**—Mastitis occurs in 5 to 6 per cent. of nursing women. It is met with oftener after first than subsequent labors. It is commoner in blondes than in brunettes.

**Causes.**—Predisposing causes of mammary infection are bad general health, lowering the resisting power ; milk

stasis, injuring the vitality of the epithelium of the lactiferous ducts; lesions of the nipples, opening avenues for absorption.

The exciting cause is sepsis. The pus-producing organisms may gain access to the gland through nipple lesions, through the milk-ducts, or exceptionally by the blood-channels from remote septic foci. Staphylococci are sometimes found in the milk of healthy nursing women.

**Forms.**—(1) Subcutaneous. (2) Glandular, or parenchymatous mastitis; this is in the majority of cases a lymphangitis. (3) Subglandular paramastitis. Two or all these forms may coexist.

**Diagnosis.**—The *subcutaneous form* presents the characters of ordinary phlegmon; it is usually single.

The *glandular form* is characterized by more pain and more constitutional disturbance than the subcutaneous; it is generally ushered in by a chill; it is often multiple; the gland is indurated.

*The Subglandular Form.*—In subglandular suppuration the temperature is persistently high, the pain is deep-seated, the gland is not indurated and it floats on the underlying fluid. The diagnosis may be confirmed by passing an exploring-needle beneath the gland.

**Treatment.** (1) *Prophylactic.*—In simple milk engorgement without inflammation, massage is indicated. The breast should be stroked gently from the base toward the apex. Restrict the amount of liquids ingested. Hypersecretion may be relieved by saline cathartics, or in non-nursing patients by the topical use of oleate of atropia. Engorged breasts should be supported firmly with a compression binder. A pad of cotton-wool is

placed under the binder over each breast to distribute the pressure evenly. An opening in the center of each pad relieves the nipple of injurious pressure. The use of a compress as tight as can well be borne is of great value both as a prophylactic and a curative measure. The Murphy binder, made of a straight piece of muslin with a deep notch cut in one side for each arm and a shallow one in the center for the neck is recommended. A skilfully applied roller bandage is most suitable when but one breast requires compression. Tonics, especially quinine, are useful. The aseptic management and curative treatment of nipple lesions are an essential part of the treatment.

2. *Abortive*.—Absolute rest of the gland for one or two days, restriction of liquids, saline cathartics, oleate of atropia, locally, with care lest the milk secretion be too much repressed, quinine, gr. v to x twice daily, are useful abortive measures.

Another plan of abortive treatment consists in occasional removal of the milk with a breast pump, applications of ice, and parenchymatous injections of one-half drachm of a 3 per cent. carbolic solution. The injections are repeated two or three times at intervals of twelve hours.

3. *Treatment of Suppuration*.—The pus-cavity should be opened early and freely, with antiseptic precautions. The incision should radiate from the nipple, the areola being avoided. The abscess-cavity is to be thoroughly cleansed and disinfected. For this purpose the peroxide of hydrogen is a good non-toxic disinfectant. Counter-openings may be necessary for satisfactory drainage. Leave a drainage-tube in each opening; apply antiseptic

dressings and compression to obliterate the cavity. Cleanse antiseptically once or twice daily and renew the dressing.

*Treatment of Sore Nipples.*

The nipples are to be cleansed after each nursing with a saturated aqueous solution of boric acid. They are then dried and saturated with fresh cacao butter. In excoriation the following nipple lotion is sometimes useful :

R.—Plumbi nitratis . . . . . gr. x.  
 Glycerini . . . . . ʒij.  
 Aquam . . . . . ad ʒj—M.

A soothing antiseptic dressing, and one that does not need to be washed off before nursing is the following :

R.—Glyceriti amyli }  
 Bismuthi subnitratis } . . . . . āā ʒss.

Cleanse the nipples with the boric acid solution after nursing and reapply the bismuth mixture.

A 2½ per cent. aqueous solution of carbolic acid is a good antiseptic nipple lotion.

Should these measures fail, rest the nipple for twenty-four or thirty-six hours, or let the child nurse through a nipple shield.

To relieve pain during nursing, apply five minutes before a 1 or 2 per cent. solution of cocaine previously sterilized by boiling, or better a saturated alcoholic solution of orthoform. Wash off immediately before nursing.

Fissures may be lightly touched once daily with a stick of nitrate of silver, first pencilling with the cocaine solution. Pencilling with a 1 to 5 per cent. solution of silver nitrate is efficacious and has the advantage over the solid stick of being practically painless. A protargol solution, ʒj and ʒj, may be substituted for the nitrate. Painting

the affected surface with compound tincture of benzoin or with ichthyol several times daily is useful, or the fissures may be cleansed with a 1 per cent. bichloride of mercury solution, and after drying with sterile cheese cloth painted with thiol collodion, 10 per cent. The opening of the milk ducts must not be closed. A nipple shield may be worn till healing has taken place.

### PUERPERAL INFECTION.

Puerperal infection is a wound infection identical with that of surgical practice. Synonyms are puerperal fever, puerperal septicæmia, metria.

**Frequency.**—In pre-antiseptic times puerperal fever was a common affection in child-bed. The mortality from this cause in hospitals was from 2 to 6 per cent., and so-called epidemics with a death-rate of 10 per cent. or even more were of frequent occurrence. To-day, in well-managed maternities less than a fourth of 1 per cent. of puerperal women die from septic infection.

Bumm found a morbidity of 20 per cent., assuming 100.5° F. as the normal limit of temperature.

In general private practice, without antiseptics, there is about 1 per cent. of septic deaths, and a large proportion of women who survive infection are seriously, often permanently, crippled in health. From 15 to 20 per cent. of women dying during the child-bearing age die of puerperal fever. Under a strict asepsis there are practically no deaths from puerperal infection in family practice, and the morbidity does not exceed 10 per cent.; even that is usually of a mild type. The disease is observed more frequently in primiparæ than in multiparæ.

**Etiology.**—The cause is the introduction of septic

germs into the wounds of the birth-canal during labor or the puerperium. Conditions which impair the resisting powers act as complicating causes. The puerperal state at its best is one of lowered resistance.

*Bacteriology.*—The organisms most constantly concerned are the streptococci; staphylococci are frequently met with. The bacterium coli commune, the gonococcus, the bacillus of diphtheria and certain other microorganisms are occasional factors in the pathogeny. Putrefactive bacteria are generally present. Putrefaction of lochia produces a soil favorable for the development of pathogenic organisms. The putrefactive bacteria act solely, others largely, by the effects of their chemical products, toxins.

*The sources* of the infecting organisms are the lochia of puerperal fever patients, secretion from suppurating wounds, erysipelas, diphtheria, and in certain cases scarlet fever or typhoid fever owing to complications involving the presence of wound-infection germs, also cadaveric and other dead and decomposing animal matter. Gonorrhœa is sometimes the source. Self-infection—auto-infection—in the true sense of the term does not exist. The term as now used is applied to infection from septic matter primarily present in the genital tract. Infection from the latter source is probably possible only in diseased conditions of the genital mucosa.

*Vehicles of infection* are the hands of the obstetrician or the nurse, instruments, utensils, cloths, germ-laden dust, etc.

*The avenues of absorption* are the obstetric wounds of the vulva, vagina, the cervix and corpus uteri, and even intact surfaces of the genital mucous membrane. Systemic infection and that of the uterine adnexa spring most fre-

quently from the cavity of the uterus, especially from the placental site.

*The channels of diffusion* are usually the lymphatic. Less frequently the veins.

**Special Manifestations** are: Endometritis; salpingitis; oöphoritis; metritis; parametritis; perimetritis or pelvic peritonitis; diffuse peritonitis; uterine lymphangitis and phlegmonous lymphadenitis—generally accompanied with peritonitis; phlebitis—uterine, peri-uterine, and crural; colpitis; pure septicæmia; acute ptomain-poisoning—putrid intoxication; sapræmia; pyæmia; cystitis; uretero-pyelitis, pneumonia, pleurisy, pericarditis, endocarditis, nephritis, arthritis, subcutaneous phlegmons, and others.

**Diagnosis.** *General Symptoms of Infection.*—Usually the first symptoms appear on the second or third day after labor, rarely later than the fourth or fifth, since the obstetric wounds have by that time begun to granulate, and the granulation layer acts as a barrier to the invasion of the pyogenic organisms. In the majority of cases the disease begins insidiously. The attack is sometimes ushered in by a more or less pronounced chill.

The most conspicuous early symptoms are rapid pulse, 100 to 140; rise of temperature, 102° to 104° F., fetid lochia—yet sepsis often occurs without fetor. The bad odor is due to the presence of putrefactive bacteria or of the colon bacillus, and is often absent at the onset of sepsis in the most virulent forms of puerperal infection. Exclude malarial pyrexia by quinine or better by microscopic examination of the blood for plasmodia malarie; exclude also pneumonia, typhoid fever, fecal retention, emotional, mammary and other non-septic causes of high temperature.



*Symptoms of Special Lesions.*

**Endometritis.**—This is the lesion most constantly present in puerperal sepsis. The uterus is more than normally sensitive on palpation over the lower abdomen; the cervix is more patulous than normal for the time; the uterine lochia are often foul; the bloody flow is usually prolonged. Generally owing to a greater or less degree of accompanying metritis the uterus is somewhat boggy, tender on pressure, and involution is retarded.

Sometimes the septic process is limited to the endometrium, the organisms not penetrating beyond the granulation-zone. When for any reason that protection fails the sepsis becomes widespread and the systemic disturbance proportionately greater. Occasionally in profound general sepsis the endometritis may be insignificant owing to early migration of the offending organisms into other structures.

**Metritis.**—This originates in a lymphangitis of the uterine walls. It is generally secondary to an endometritis. Portions of the muscularis may slough—dissecting metritis. After-pains are severe and prolonged. The uterus is large, soft and boggy and tender to the touch.

**Parametritis and Perimetritis.**—There are pain and tenderness at the seat of inflammation, moderate tympanites, frequently nausea; the lochia are scanty; an exudate is found in one or both broad ligaments by abdominal or bimanual examination; the uterus is more or less fixed, sometimes displaced; fluctuation may generally be made out at the seat of the exudate if pus forms. Abscess results in 20 per cent. of cases. The pus-collection may be in the broad ligament, extra-peritoneal, or it may be in-

tra-peritoneal and encysted, the result of a circumscribed peritonitis and agglutination of surrounding structures, or of walling off by exudate.

**Diffuse Peritonitis.**—The route by which the pyogenic organisms reach the peritoneum is almost invariably the lymphatics. There are exquisite abdominal pain and tenderness in the early stages generally; later tenderness may partially or wholly disappear. Tympanites is usually extreme. There is vomiting of greenish fluid, diarrhoea, and finally collapse. The termination is almost surely fatal within a week.

**Phlegmasia Alba Dolens, Milk-leg** is primarily a lymphangitis. Its origin is parametritis, the inflammatory process extending along the courses of the great blood vessels of the thigh. Phlebitis results secondarily.

The period of invasion varies from two to three or four weeks after delivery. The attack is sometimes ushered in with a chill, and is always attended with pain and swelling in the affected limb. The pain is first felt in the groin, and usually extends throughout the length of the thigh and leg within a few hours. The limb becomes swollen, tense, hard, white, glistening. The affected veins may sometimes be felt on palpation, as hard, irregular cords. They are frequently nodular, owing to the formation of thrombi. The fever is at first of a remittent, then an intermittent type. Resolution generally begins after about two weeks. The duration of the disease may be many weeks; abscess-formation or gangrene sometimes supervenes. There remains more or less œdema on standing or walking with impairment of muscular power. In a certain proportion of cases the disability may last for months or indefinitely.

A possible termination is sudden death by pulmonary embolism from the detachment of a fragment of blood-clot. Recurring chills are a signal of metastatic affections. The disease may extend from one limb to the other.

**Colpitis.**—The usual evidences of vaginal inflammation, catarrhal, phlegmonous, ulcerative or diphtheritic are present; in ulcerative vaginitis the labia are often œdematous. In the phlegmonous form abscess may result. Membranous exudates are very rarely due to a true diphtheria, usually to infection with pyogenic organisms.

**Pure Septicæmia** is characterized by fever with absence of appreciable organic lesions; the countenance is sallow, sunken, anxious. Occasionally there is delirium or coma; diarrhœa and vomiting of dark grumous ejecta are frequently observed. It runs a rapid course, often terminating within two or three days.

**Pyæmia.**—Pyæmia originates most frequently in infection of the mouths of veins at the placental site. The phlebitic process may be limited or diffuse. By the breaking down of infected thrombi, septic emboli and metastatic abscesses in various parts of the body may result. Septic pneumonia is a common complication.

Pyæmia is distinguished by irregularly recurring chills, marked irregularity of the temperature, and by metastatic development of purulent foci. The duration may be many weeks. Often it progresses to a rapidly fatal termination.

**Cystitis** is attended with vesical tenesmus and increased frequency of urination. In the acute stage the tenesmus is almost constant, and is not relieved by emptying the bladder. Pain is sometimes excessive, and there is usually some elevation of temperature. The urine is cloudy and of feebly acid reaction; sometimes it is fetid.

**Uretero-pyelitis.**—In uretero-pyelitis there is frequent desire to urinate, with pain and tenderness along the inflamed tract. Pressure on the ureter through the vagina by conjoined manipulation elicits pain and desire to urinate. The urine is acid and contains pus and blood. The temperature is very high in the acute stage.

In most cases of puerperal infection several of the lesions above described coexist.

**Prognosis.**—As a rule the earlier the attack the more unfavorable the prognosis. It is gravest in acute putrid intoxication, diffuse purulent peritonitis, pyæmia. Generally the prognosis is best when the septic process is distinctly localized.

**Treatment. Prophylactic.**—To prevent infection enforce a rigorous asepsis of the hands, instruments, utensils, and of everything that comes in contact with the genitals during labor and the puerperium. Cleanse antiseptically the external genitals, lower abdomen and inner surfaces of the thighs before internal examinations. Disinfect the vagina and cervix before and during labor for cause. Examine by the vagina during labor as seldom as possible. In many cases vaginal examinations may, when, for any reason, more than ordinary care is required, be omitted altogether. Prevent all preventable injuries of the passages. Under modern methods of prophylaxis there should be practically no mortality from puerperal infection in private practice.

**Remedial General Treatment of Infection.**—The treatment may be summed up in a few words: Dislodge the enemy, when possible, and reinforce the resisting powers of the patient.

**Catharsis.**—On the first rise of temperature give calomel, gr. v to gr. x, and follow with a saline, Epsom salt.

Repeat the saline, as required, to procure three or four watery movements daily, if the strength of the patient permits. Hypercatharsis applies especially to the first few days of the fever, and should be continued only so long as the temperature and other symptoms improve under it.

Spontaneous diarrhœa is generally conservative, and should not be checked unless excessive. Should it be necessary, the subnitrate of bismuth, gr. x q. 2 to 4 h., may be given. A pelvic examination should be made to determine, if possible, the seat of infection.

*Vaginal Disinfection.*—A careful digital and speculum examination to locate the primary focus of infection is a necessary preliminary to treatment. Vagina alone involved, douche with a 2 to 3 per cent. solution of hydrogen peroxide, a 1 in 10 to 15 dilution of Labarraque's solution or 2 per cent. carbolic solution. If the temperature falls, repeat the douche as soon as it rises again. Ulcers and necrotic or pseudo-diphtheritic patches should be touched once or twice daily with tincture of iodine, a 50 per cent. chloride of zinc solution, or with carbolic acid. Before any interference within the passages as rigorous an antiseptic preparation is required as for a major surgical operation.

*Intrauterine Douching.*—Intrauterine measures are indicated only when the seat of infection has been found to be the uterus. The douche should be given only by the physician. Patient should be on a table and the asepsis should be as elaborate as for a capital operation. Irrigant may be warm iodine water, of port wine color, peroxide of hydrogen or normal salt solution. Quantity should be two or three gallons. The douche is best given

with a fountain syringe armed with a glass irrigating tube with openings only at the end. It is a useful measure if the temperature falls after it. It may be repeated as soon as the temperature rises again.

*Curettng.*—Curettng is indicated in the presence of gross necrotic material. It should be omitted when the inner surface of the uterus feels smooth to the examining fingers.

*Support* the patient with tonics, stimulants and forced feeding. Give strychnine, gr.  $\frac{1}{40}$  to gr.  $\frac{1}{20}$ , hypodermically every four hours, and brandy to the extent of a pint or quart daily; instead of brandy, whiskey or an equivalent of wine may be preferred. To realize the full benefit of the alcohol it should be pushed to the point of intoxication. The subcutaneous injection of a pint to a quart of the normal salt solution two or three times daily is sometimes of great service as a stimulant and eliminant.

*Antipyretics.*—Reduce the temperature by cold sponging, cold packs, or the use of a cold coil.

The coal-tar antipyretics serve only to mask the symptoms and are depressing and otherwise injurious. Quinine is useless in purely septic fever except in small doses, gr. ij or iij t. i. d., as a tonic. Even for the latter purpose it is inferior to strychnine.

*Narcotics.*—An occasional opiate in small doses, morphine, gr.  $\frac{1}{8}$ , or codeine, gr.  $\frac{1}{4}$ , may rarely be required in case of extreme nervous excitement or sleeplessness, but should be withheld if possible.

*Treatment of Peritonitis.*—Saline cathartics with large stimulating enemata, to secure several copious evacuations daily are often of service. Moderate doses of opium will rarely be needed for control of pain and restlessness.

Dietetic supports, tonics and stimulants are the chief reliance in systemic infection. In localized purulent peritonitis open the abdomen, cleanse and drain the pus-cavity. The drainage should be established through a posterior vaginal incision if possible, and the suprapubic incision closed. In diffuse peritonitis abdominal section is rarely if ever successful. Gauze drainage of the peritoneum through the posterior vaginal fornix might be of service at the beginning of a peritonitis.

**Treatment of Parametritis.**—Hot vaginal douches, several gallons at a temperature of  $110^{\circ}$  to  $120^{\circ}$  F., may be given two or three times daily. Local antiseptic and general tonic measures are indicated as in other septic conditions. If abscess forms evacuate early and drain by the vagina or abdomen. Operation by the vagina is generally safest and it effects the best drainage. This route should be chosen except when the pus-cavity cannot safely be reached from below. In the latter event the incision should be made just above Poupart's ligament and parallel with it.

**Treatment of Phlegmasia Alba Dolens.**—The limb should be kept at rest in a horizontal position. Pain may be subdued by the local application of oleate of morphia. After the application the limb is enveloped with a single thickness of muslin wrung out of hot water, and this covered with oiled silk. Ichthyol and glycerine, 1:4, applied twice daily over the entire limb frequently yields brilliant results.

Avoid massage during the active stage of the disease; it may cause embolism. Should abscesses form they should be treated by early and free incision, followed with thorough cleansing and drainage. The patient may leave



the bed when the swelling subsides and the fever has long since ceased. From that time the affected limb should be supported by means of a flannel bandage or an elastic stocking. The support should be continued so long as much swelling occurs on standing or walking.

**Treatment of Pyæmia.**—The general treatment is essentially the same as in septicæmia. Metastatic pus-foci should be opened and drained if accessible.

**Treatment of Cystitis.**—A mildly alkaline water should be drunk freely as a diluent. The bowels must be kept freely open, and the diet should be non-stimulating. Sweet spirit of nitre, four to six times daily, helps to relieve pain. When the acute stage has passed oil of sandalwood in doses of 10 to 20 drops from three to six times daily is most useful.

**Treatment of Uretero-pyelitis.**—Water is to be used freely by the stomach or by high rectal injections to flush the septic tract by increased secretion of urine. Salol in doses of five grains every three hours is useful as an antiseptic. Here, as in cystitis, the oil of sandalwood is especially valuable. The cystitis must be treated.

### SUDDEN DEATH IN CHILD-BED.

Among the principal causes of sudden death in child-bed those most frequently encountered are shock, syncope, apoplexy, advanced cardiac disease, acute pulmonary œdema, pulmonary embolism and thrombosis. The latter two are the most frequent. Phlebitis, varicose veins, prolonged labor, anæmia, hemorrhage, sepsis, cancer, syphilis, predispose to embolism and thrombosis.

## CHAPTER VIII.

### OBSTETRIC SURGERY.

#### INDUCTION OF PREMATURE LABOR.

**Indications** are certain cases of narrow pelvis, in which the delivery of a living and viable child is thus possible, flattening to between 7 and 9 cm.,  $2\frac{3}{4}$  to  $2\frac{1}{2}$  inches, or equivalent contraction of other forms; foetal death; habitual death of the foetus in the last month of gestation from other causes than syphilis; nephritis of pregnancy, drug and dietetic measures failing; dangerous cases of placenta prævia after the period of viability, and accidental hemorrhage; certain cases of hydramnios, with danger to mother or child.

1. *Pelvic Contraction*.—Here the most difficult problem is to fix the proper time for interference. Operating too soon, the interests of the child, too late, those of the mother, are imperiled. The most reliable data for deciding the question are afforded by careful measurements of the pelvis and of the child, especially the foetal head. Crowd the head into the pelvic brim with one hand over the abdomen while the other is passed internally to learn how far and with how much freedom the head descends under repeated examinations at intervals of one or two weeks. The labor should be brought on as soon as the head is found to enter the pelvis with difficulty.

The operation is seldom to be chosen in preference to

its alternatives in pelvic contraction. While its maternal death rate is nearly nil the foetal mortality is about 33 per cent.

2. *Habitual Death of the Fœtus*.—Operate a week or two before the usual period of foetal death. The strength and frequency of the foetal heart and the vigor of the foetal movements must be watched closely as the fatal period approaches.

3. *Nephritis*.—The pregnancy should be terminated on the appearance of grave symptoms, especially if the foetus has reached the full period of viability and medical and dietetic treatment have failed.

4. *Hemorrhage*.—In placenta prævia and in accidental hemorrhage, after the period of viability, it should be the rule to induce labor as soon as the diagnosis is established.

5. *Hydramnios*.—Here interference is called for when the life of mother or child would be jeopardized by longer continuance of the pregnancy.

**Methods.** (*a*) *Catheterization of the Uterus*. *First Step*.—Separation of the membranes from the lower uterine segment by means of a uterine sound or with the finger. The operation must be aseptic.

Detachment of the membranes with the sound may be done with the woman in either the left lateral or dorsal recumbent position. For the use of the hand the dorsal position is best.

*Second Step*.—Insertion of one or more English bougies between the membranes and the uterus. (Krause.)

No anæsthetic is required. Usually the bougie is most readily passed with the aid of the Sims position, the cervix being drawn forward and held with a volsella. The bougie is sterilized by boiling or steaming, the proxi-

mal end is cut off and a stylet inserted. Great care must be used to avoid rupturing the membranes. The instrument is then pushed up gently and in the direction in which it passes most easily. After it has entered between the membranes and the uterine wall the stylet is drawn down about one inch. The flexible tip of the bougie finds its way readily with little risk of perforating the membranes. The bougie fully in place the stylet is withdrawn. A second bougie may be inserted if it can be pushed into place without too much difficulty. Bleeding is probable evidence that the instrument has passed behind the placenta. It is then best to withdraw it and pass it in another direction. A light tampon of gauze may be packed in the vagina, but it is not required to support the bougie. The instrument is left to be expelled with the child. Labor is usually established within twenty-four hours. This method is not suited to cases in which immediate delivery is called for.

(b) **Tamponade** of the cervical canal and the vagina with plain or borated gauze. The gauze is applied in long strips, with the patient in the Sims position, and the perineum well retracted with a Sims speculum. The tamponade must be as firm as it can be made, and must completely fill the vagina and be held in place by means of a T-bandage. The cervix and vagina if required should be cleansed before packing. The gauze tampon is renewed daily till labor is established, the vagina and the cervical canal being douched with sterile water or salt solution before repacking. The method acts slowly, and is therefore unsuitable when prompt delivery is demanded. It is especially adapted to cases of hemorrhage.

(c) **Manual Dilatation of the Cervix.**—The woman is

placed in the lithotomy position under an anæsthetic. The vulvar hair is clipped short and the external genitals are disinfected. The vagina and cervix if healthy require no disinfection. If diseased the vagina is gently scrubbed with soap and water, using sponge compresses held in the grasp of straight forceps. Finally, it is douched for five minutes with one of the mercurial solutions, using gentle friction with sponge compresses frequently renewed. The cervical canal is cleansed with equal care.

The operator then lubricates his hand well with aseptic glycerin. Coning the fingers the hand is introduced into the vagina. One finger is passed through the cervix. After a time the cervix relaxes till a second finger can be passed, then one finger after another until the whole hand is introduced. The first is then slowly and cautiously closed in the grasp of the cervix. By this time the dilatation is sufficient for the passage of the head, and at the same time active uterine contractions have been established.

The dilatation must be done with the least possible muscular effort, to prevent cramping of the hand. To prevent laceration of the cervix extreme care must be used, taking plenty of time for each step. The danger of tearing is greatest in the latter part of the dilatation. The uterus is steadied by counter-pressure over the fundus lest by pushing the uterus upward the vagina be exposed to too great strain.

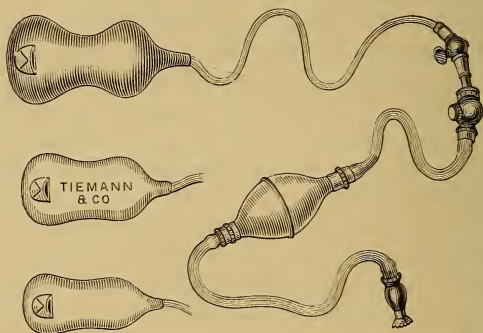
Should the indications warrant immediate extraction may be undertaken by version of forceps. Delivery is thus possible within fifteen minutes to two or three hours, according to the rigidity of the cervix and the difficulty of extraction.

When the cervical canal is too small to admit the finger easily the dilatation may be commenced with a branched steel dilator. Or, if time permits, a cervical and vaginal tampon may be placed and left for twenty-four hours. By the end of that time the cervical canal will be found sufficiently expanded to receive the finger.

Edgar dilates by hooking one or two fingers of one hand in the cervix anteriorly and one or two fingers of the other hand posteriorly and pulling in opposite directions.

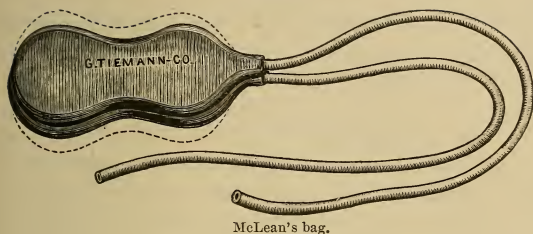
The method of artificial delivery by rapid dilatation of the cervix is a dangerous one except at the hands of a trained and skillful operator, and is to be reserved for emergencies only. No important injury need result from lacerations of the cervix if they are properly sutured at the close of labor, but without the greatest caution the tear may extend into the lower uterine segment and even into the peritoneum. Dilatation of the cervix by means

FIG. 62.



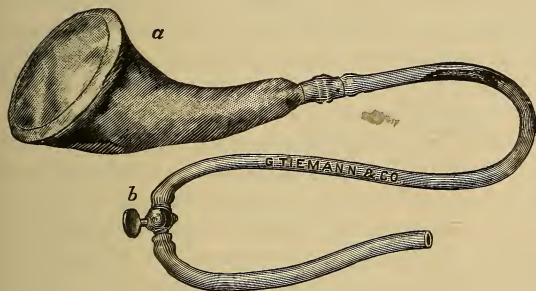
Barnes' dilating water-bags.

FIG. 63.



McLean's bag.

FIG. 64.



Champetier de Ribes bag.

of water-bags is tedious, but is generally safer, and is to be preferred when the indication for delivery is not too urgent. (Figs. 62, 63, 64.)

(e) **Dührssen's Incisions.**—In this operation four longitudinal incisions are made in the cervix at equal intervals. They are best located a little to one side of the anterior, the posterior, and right and left aspects of the cervix respectively. They should extend to the vaginal junction. With the patient in the dorsal position and the cervix drawn down with a volsella, and using two fingers of the



left hand as a guide, one within and the other without the cervix, the cuts are made with a strong straight scissors. The method is applicable only after dilatation has progressed far enough to obliterate the internal os. The preliminary dilatation may be accomplished by manual or instrumental intervention, if it has not already taken place spontaneously. The operation, when done as described, affords ample space for extraction of the child. The incisions should be closed, after delivery, by immediate suture.

**Care of the Child.**—Generally in case of premature children the use of an incubator will be required. In hospital practice an Auvard's, Credé's, Rotch's or Marx's apparatus should be provided. For use in private practice an improvised incubator of wood or metal may readily be constructed. It should have a removable cover and a false bottom. The child is placed in the upper chamber and hot bottles, or a metal water tank heated by an alcohol lamp in the lower. Air admitted to the lower chamber flows into the upper through several half-inch perforations at one end of the false bottom, escaping by similar perforations at the opposite end of the top or cover. A thermometer in the upper chamber should register constantly about 90° F. A glass window in the top of the incubator permits observation of both child and thermometer. The usual period of incubation is from one to three months. Meantime the child is removed from the warm chamber only for nursing, bathing, and changing of clothing.

Recourse must be had to gavage, feeding through a soft stomach-tube, when the child is unable to nurse the breast or bottle or to be fed from a spoon. Better than the stomach tube is feeding through the nares by means of a nar-

row-pointed spoon. By incubation and gavage 20 per cent. of children born at the sixth month may be saved. The viability is correspondingly greater in more advanced stages of gestation.

### INDUCTION OF ABORTION.

**Indications.**—1. *Pregnancy nephritis* with grave symptoms not yielding to other measures; *chronic nephritis*. In chronic nephritis the termination of the pregnancy is demanded because development to viability and the birth of a living child are exceedingly rare and the child if born alive is puny and feeble. The mother's life, too, is seriously jeopardized by the continuance of the pregnancy. Even if she survives the pregnancy and the labor grave injury will have been done to the crippled kidneys.

2. *Uncontrollable Vomiting of Pregnancy*.—Medicinal and dietetic measures failing, the uterus should be emptied before the occurrence of grave symptoms.

3. *Extensive Vesicular Degeneration of the Chorion*.—The diagnosis established and no evidence of foetal life being discovered, the uterus should be evacuated promptly.

4. *Irreducible Retroversion of the Gravid Uterus*.—The retroverted gravid uterus is very rarely irreducible, before the third month. Before resorting to abortion, the usual measures for reduction, with the woman in the Sims or the genu-pectoral position, should have had a fair trial.

5. *Absolute Contraction of the Pelvis*.—The termination of the pregnancy in the early months is demanded, on election of the mother, especially in conditions unfavorable for cœliotomy. This applies to contraction of the

soft parts and to obstructing tumors as well as to distortion of the bony pelvis.

6. *Pernicious Anæmia.*

7. *Chorea.*—Chorea as a complication of pregnancy is generally an intractable disease and sometimes dangerous to life.

8. *Death of the ovum* calls for evacuation of the uterus immediately the diagnosis of death of the fœtus can be established positively.

9. *Chronic Heart Disease.*—In advanced cardiac disease the heart suffers impairment owing to the extra tax to which it is subjected in the later months of pregnancy, and the life of the patient is seriously jeopardized at labor.

**Methods.** 1. *Detachment of the Ovum and Tamponade of the Cervix.*—Abortion may be induced by partially detaching the ovum with a uterine sound aseptically, or by the use of the cervical and vaginal tamponade with plain or boric acid gauze as already detailed under induction of premature labor, or these procedures may be employed conjointly. The tampon is renewed after twenty-four hours. The strictest asepsis must be observed.

2. *Immediate evacuation of the uterus with the curette* is the method preferred by the writer. The patient is placed under an anæsthetic in the lithotomy or in the Sims position. The external genitals are scrubbed for five minutes by the nurse with soap and hot water. The operator then scrubs the vulva and immediate surroundings with soap and hot water. For cleansing the skin a soft aseptic brush or the hand may be used. The vagina if infected is cleansed and douched with one of the mercurial solutions for five minutes and the external sur-

faces flushed with the same, using friction with fresh compresses. The cervix is exposed by the aid of a Sims speculum, is drawn down with a volsella, and its canal is also cleansed and disinfected. The cervix is now dilated sufficiently to easily admit the largest curette to be used, care being taken to avoid lacerating the tissues.

When gestation has not advanced beyond the second month, the ovum may be broken up and the larger portion of it brought away with a Keith forceps; the remaining fragments and the decidua are then removed with the curette.

The Keith or similar straight forceps will be found useful for the removal of *débris* that is not brought away by the curette or by douching. The curetting is best done with a sharp curette and should be continued till the decidua has been removed.

The operator knows by the peculiar grating sound and by the harsh feel when the instrument has reached the uterine wall. The ovum or the decidua has a smooth or spongy feel, and gives out no sound as the curette is drawn over it. The sharp curette does its work with much lighter pressure than the dull instrument and, therefore, with less injury by bruising; with proper care it will not cut too deeply.

The uterine cavity is finally douched thoroughly with a  $\frac{7}{10}$  per cent. salt solution or with plain sterilized water. A half drachm of fluid extract of ergot may be given hypodermically as a precaution against hemorrhage. In aseptic conditions no pack is required and no vaginal dressing.

When the contents of the uterus have become necrotic the cavity should be irrigated with the mercurial or other

equally active antiseptic solution. In such cases the uterus may be packed lightly with gauze after curetting. The gauze usually becomes foul and must be removed in twenty-four hours. Repacking is seldom advisable.

When the gestation has advanced much beyond the second month the dilatation may be begun with the steel dilator and completed with the fingers. The fœtus is brought down and extracted by seizing the feet and the secundines delivered by conjoined manipulation. For manual evacuation the patient should be in the dorsal recumbent position.

For the protection of the physician it is a rule of practice never to induce abortion except with the approval of competent counsel.

#### REMOVAL OF AN ABNORMALLY ADHERENT PLACENTA.

**Note.**—The existence of abnormal adhesion of the placenta may be assumed, as a rule, when the after-birth cannot be delivered entire by ordinary external and internal manual methods within two hours after the birth of the child. Mere retention, however, by partial closure of the retraction-ring must not be mistaken for adhesion.

**Etiology.**—The etiology is not definitely understood. The cause of pathological adhesions of the placenta resides probably in a diseased condition of the endometrium antedating the pregnancy and resulting in deciduitis and placentitis. It should be remembered that an abnormally retained placenta is, as a rule, at least partially adherent and that the adhesion is very seldom pathological except in persistence. Unnaturally firm adhesion of the kind

which is attributable to inflammatory causes is extremely rare.

**Treatment.**—The treatment is separation and extraction of the placenta with the hand in the uterus. The patient should be placed in lithotomy position upon a suitable table. A rigid asepsis must be observed. The separation is begun at the portion already detached. Care must be taken that no fragments remain. After evacuating the uterus give a hot intrauterine douche of a 2 per cent. solution of creolin or of hot saline solution. Inject 30 minims of fluid ergot hypodermically.

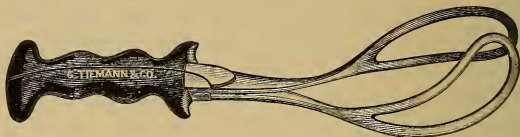
The removal of an adherent placenta with the naked hand even though carefully disinfected is always attended with serious risk of infection. A safeguard against infection in intrauterine manipulation is the boiled rubber glove with gauntlet.

### FORCEPS.

**The Instrument.**—The obstetric forceps consists of two crossed arms locking at the point of intersection. Each arm has four parts, handle, shank, lock and blade. The blades are shaped to grasp the foetal head as with a pair of hands. They are also curved in conformity with the direction of the birth-canal. For lightness as well as for wider distribution of the pressure the blades are fenestrated. When the instrument is locked the handles fall nearly together, affording a convenient grasp for the operator's hand in applying traction. A forceps for general use should be about 38 cm., 15 inches, long, and should have a moderate pelvic curve and an elliptical cranial curve, 17 to 18 cm., about 7 inches, long, and 7.5 cm., 3 inches, in width externally at the widest part. The space between

the tips of the blades when the instrument is closed should be 1.3 cm., about  $\frac{1}{2}$  inch. To admit of sterilizing by heat it is best made wholly of metal. (Fig. 65.)

FIG. 65.



The author's forceps.

It should be thoroughly cleansed with soap, hot water, and a brush after using; should always be sterilized, best by boiling in the soda solution, immediately before using. It should be kept free from rust and well polished and the nickel plating must occasionally be renewed.

**Mechanical Action.**—The essential function of the forceps is traction.

Its use as a lever, by means of a pendulum motion during extraction, is a mechanical gain, but is liable to injure the maternal soft parts.

The use of forceps as a rotator is considered under treatment of occipito-posterior positions of the vertex and of face presentation.

Compression of the head with forceps is attended with danger to the child and but little mechanical advantage for extraction. In most seizures compression of one is compensated by elongation of another transverse diameter. More may be gained by slow delivery, permitting time for moulding of the head under the pressure of the pelvic walls. The pressure of the blades should be kept at a minimum, and if possible should be light enough to leave no marks upon the child.



**Indications for Forceps.** 1. *Forces at Fault.*—Cephalic presentation in which the natural powers are clearly inadequate.

Generally—not always—when the head has remained stationary for a half hour after two hours in the second stage.

2. *Passages at Fault.*—Flattening, not below three and one-half inches, in the true conjugate, or equivalent obstruction.

Partial obstruction in the soft parts.

As a rule, the forceps is permissible only after the head has engaged or can be made to engage. In most instances symphysiotomy or Cæsarean section is better than a very difficult forceps extraction.

3. *Child at Fault.*—Among the indications for forceps presented by the fœtus are :

Arrested occipito-posterior positions.

Arrested face presentation in anterior position.

Moderate hydrocephalus.

After-coming head.

Impacted breech.

Fœtal pulse above 160 or below 100.

In impacted malpositions of the head and in irreducible face or brow presentation symphysiotomy may be considered.

*Complicated Labor.*—Forceps is often required in emergencies arising from other causes than faulty mechanism and in which immediate delivery is indicated in the interest of mother or child. This indication may be present before the head engages. Under this head may be mentioned certain cases of accidental hemorrhage, prolapsus funis, rupture of the uterus, and of eclampsia, for rapid de-

livery, or of placenta prævia to hold the head down as a tampon.

**Contraindications** are : Head incapable of engagement, pelvic contraction below  $3\frac{1}{2}$  inches, c.v., head hydrocephalic or macerated or perforated, cervix not fully dilated and undilatable.

**Dangers of the Forceps Operation.** (a) *To the Mother.*—Possible injuries, especially in unskillful use of forceps are : In the low operation, vaginal lacerations and injuries to the pelvic floor ; in the high operation contusion and laceration of the cervix, or even the body of the uterus, shock and sepsis. Separation of the pelvic joints has resulted from the use of excessive and misdirected force.

(b) *To the Child.*—Brain injuries and especially rupture of cerebral vessels by compression are not infrequent. Permanent mental and physical infirmities and even death sometimes result from difficult forceps delivery. Temporary paralysis of the facial nerves frequently occurs. Duchenne's paralysis may result from the effect of stretching the nerve-trunks that enter into the brachial plexus. An uncleanly and unskilled forceps delivery is a dangerous operation for both patients, especially in high applications.

**Application of Forceps. Preparatory Measures.**—The patient is usually placed on the bed, or better on a table in the dorsal recumbent posture—the American obstetric position.

In difficult high forceps operations the Walcher position may be utilized as follows : The patient lies flat on her back on the table with the hips overreaching the edge and with the thighs hanging in extreme exten-

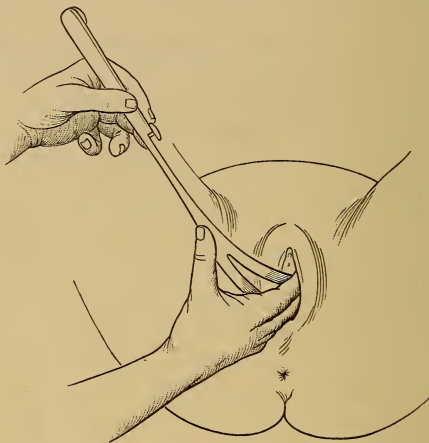
sion. In this position, owing to nutation of the sacrum, there is a perceptible lengthening of the antero-posterior diameters of the pelvis at the brim. On the other hand, at the outlet of the bony pelvis the lithotomy position offers the greatest advantage, tilting the lower end of the sacrum backward.

The woman should be anæsthetized and the hips brought close to the edge of the bed or table. The bladder and rectum must be empty. Examine the foetal heart before and occasionally during the operation. The abdomen, the thighs, and the external genitals must be cleansed and disinfected as for a major surgical operation. No vaginal antiseptics is required except after recent uncleanly contact or in the presence of a pathological vaginal secretion, purulent, greenish, yellowish, or ill-smelling. The instrument must be aseptic and the operator's hands and arms as nearly so as possible. The forceps blades may be lubricated with vaselin or glycerin which has been sterilized by heat, or simply be dipped in the antiseptic solution. A table oil-cloth, a rubber sheet, or an old rug is placed under the operator's feet to protect the carpet from being soiled by the discharges.

**Application.**—The left arm of the forceps is taken in the left hand and the blade passed on the left side of the pelvis during an interval between the pains. It is at first held nearly in a vertical position and lightly as a pen is held. Two or more fingers of the right hand are passed between the head and the left wall of the passages, the palmar surface inward; the fingers are pushed to the base of the skull if possible. The blade is passed along the palmar surface of the right hand between the head and the wall of the birth-canal, following both the pelvic

and the cranial curves, hugging the head. (Fig. 66.) After the blade has entered the passages the handle usually may best be held in the full hand. No force must be

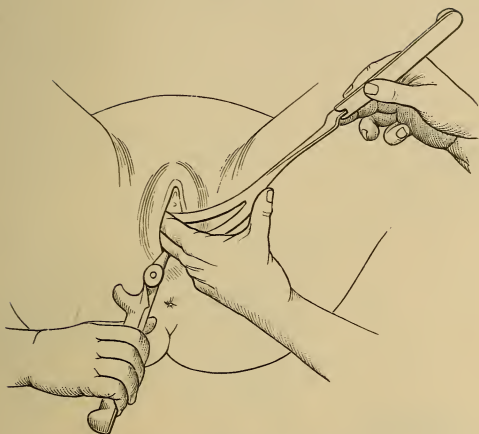
FIG. 66.



Application of first blade of forceps.

used. The right blade is introduced in similar manner, the left hand serving as a guide. (Fig. 67.) The blades are then adjusted in the best possible grasp as nearly over the transverse diameter of the head as possible. The blade is pushed sidewise into position by the use of one or two fingers against the posterior edge of either rim of the fenestra. In high applications sink the handles as far backward as the perineum will permit. If the arms do not lock readily the blades should be readjusted till they do. The locking must never be forced. Guard

FIG. 67.



Application of second blade.

against pinching the skin or hair of the vulva in the lock of the instrument. Before making traction reëxamine to see that the blades are correctly applied.

**Extraction.**—The handles are held lightly near the lock, with care to avoid compression of the head.

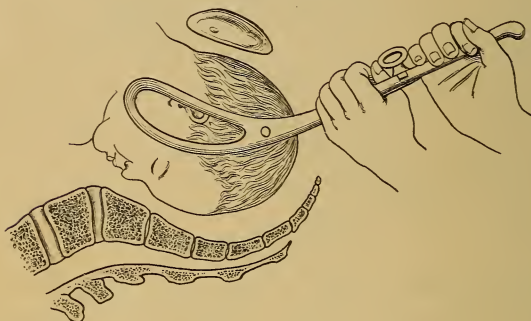
The traction should be intermittent—a pull and a pause. The pull should coincide with a pain, if possible, and should last one minute. Reinforce traction with *expressio foetus*, applied by an assistant. In the intervals of traction the instrument should be unlocked to relieve pressure on the head.

**Guard Against Slipping.**—Readjust the blades to a better grasp if they begin to slip. When the head cannot be caught primarily over the parietal eminences it

may be necessary to change the grasp, as the head rotates in course of descent. The force used must be such only as can be applied with the arms without bracing the feet.

*Line of Traction.*—The force must act in the direction of the birth-canal. In order to this, at the brim, the handles are grasped with one hand, and with the other downward pressure is applied upon the shanks near the

FIG. 68.



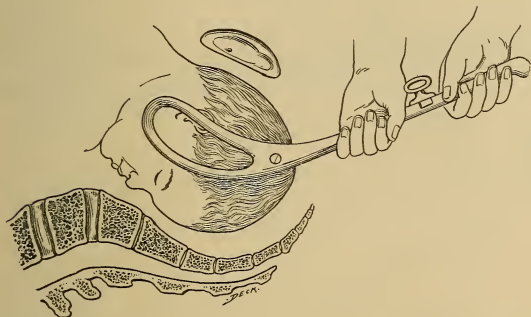
Method of applying the traction force in axis of pelvis in operation on low bed.  
(PAJOT.)

lock (Pajot). (Figs. 68 and 69.) With forceps of moderate pelvic curve a straight pull on the handles answers after the head reaches the pelvic floor.

Until the head rests on the pelvic floor the direction is practically a straight line parallel with the posterior surface of the symphysis pubis. Then the line of traction turns almost directly forward. The handles are swept upward until the anterior edges of the blades hug the ischio-pubic rami as closely as practicable without crushing the intervening soft parts.

When in doubt as to the line of traction let go the handles at frequent intervals; the direction in which they point will be that in which the pull should be applied.

FIG. 69.



Showing Pajot's manœuvre for axis traction with plain forceps; operation on high table.

*Force.*—The force required varies from ten to fifty pounds. Time is an important element in a safe forceps extraction. It is a familiar principle of mechanics that the resistance of a moving body increases as the square of the rate of motion. This is not altogether inapplicable in the forceps operation. At least half an hour should be taken for a low forceps delivery, more for a high operation.

*Perineal Stage.*—The instrument may or may not be removed during the passage of the head over the perineum. Beginners, at least, will succeed best without forceps.

A half hour or more should be given to the perineal stage of delivery except when prompt extraction is demanded in the interest of the child.



*Removal of the Forceps.*—When the blades are removed before the birth of the head the right blade<sup>1</sup> is removed first, carrying the handle well up over the opposite groin and protecting the soft parts with two fingers placed between the ischio-pubic ramus and the anterior edge of the blade; the left is then withdrawn in corresponding manner.

**Occipito-posterior Positions.**—Here the forceps operation is a dangerous and difficult one. Persistent posterior positions of the occiput imply imperfect flexion. The beginning traction should therefore be made in a somewhat forward direction, with a view to increasing flexion. For the technique of rotation with forceps, see under Treatment of Impacted or Arrested Occipito-posterior Position.

**Face Presentation.**—In mento-posterior positions as a rule, the use of forceps is not permissible. In arrested anterior positions of the face the traction should be directed forward to carry the chin under the pubic arch. In mento-posterior positions forceps as a rotator is permissible in skillful hands.

**Breech Presentation.**—Here the blades are applied over the trochanters, or one over the posterior surface of one thigh, the other over the opposite ilium and the sacrum. Application over the iliac crests is unsafe owing to the danger of injuring the child's abdomen by the pressure of the blades and even of serious injury to the bones.

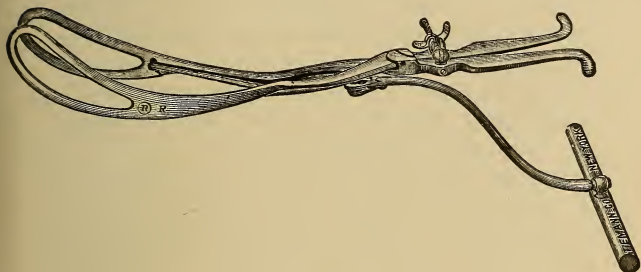
### AXIS-TRACTION FORCEPS.

**The Instrument.**—The axis-traction forceps is a plain forceps with the addition of traction rods, one attached to the heel of each blade by a movable joint at its lower

<sup>1</sup> That on the mother's right.

end. The lower ends of the traction rods are bent backward and attached by a universal joint to a cross-bar, which serves as a traction handle. (Fig. 70.) By this

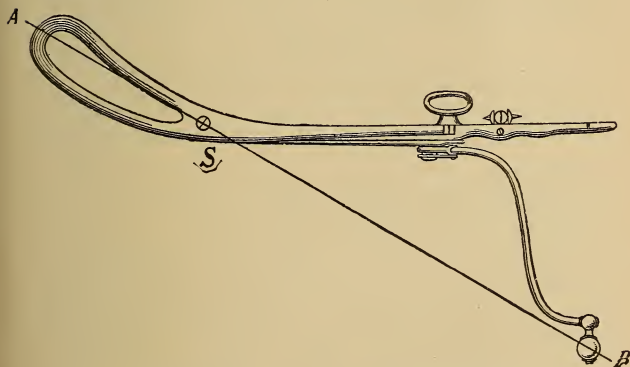
FIG. 70.



Author's axis-traction forceps.

construction the pull is directly in line with the axis of the blades, and, therefore, with the axis of the passages. (Fig. 71.)

FIG. 71.

Axis-traction forceps. *A B*, line of pull in axis of blades.

**Advantages.**—It reduces the traction force to a minimum by applying it in the line of descent and hence to the best mechanical advantage. It permits the normal movements of flexion and rotation as the head descends.

**Position of Patient.**—If the patient lies on a table the position is the dorsal recumbent; on a low bed, the latero-prone is better.

**Application.**—The blades are adjusted to light pressure, and held with the fixation screw.

**Traction.**—The pull is applied at the traction bar. The handles of the forceps serve to indicate the line of traction, which is regulated by keeping the traction rods nearly parallel with the forceps handles. The traction force should seldom, if ever, exceed fifty pounds. It is sometimes advisable in high operations to protect the pelvic floor during traction with a Sims speculum or other perineal retractor. As a rule, ordinary forceps should be substituted after the head has reached the pelvic floor.

### VERSION.

Version consists in partial or complete inversion of the long axis of the foetal ovoid by manual intervention, substituting the cephalic or pelvic pole for a less favorable presentation.

*Cephalic version* causes the head to present.

*Podalic version* causes the feet to present.

The term *pelvic version* applies when any of the elements of the pelvic pole of the foetus is substituted for some other presenting part. In its restricted sense it refers to a version which causes the breech to present, an operation which is seldom or never called for.

**Indications.**—(a) For cephalic version are: Breech presentation, if the conditions are favorable (external method before labor), shoulder presentation.

(b) For podalic version are: Flattening of the pelvis not below 9.5 cm.,  $3\frac{3}{4}$  inches, c. v.; and equivalent contraction of other forms; placenta prævia, simple cases excepted; prolapsed funis not otherwise manageable; most face cases before engagement; irreducible occipito-posterior positions before engagement; most complex presentations; shoulder presentation when cephalic version is impossible; certain emergencies demanding rapid delivery, head not engaged; the dead child may generally be delivered by podalic version in contraction to 7.5 cm., 3 inches, c. v.

**Contra-indications** to version are firm engagement of the head; high position of the retraction ring; persistent contraction of the uterus, especially in dry labors. Internal version should be undertaken only after the os is fully dilated, or nearly so, and dilatable. The absence of liquor amnii, while not a contra-indication, greatly embarrasses the operation.

**Dangers of Version.** *To the Mother.*—In external and in bipolar version the dangers are usually insignificant. Rupture of the uterus has occurred in difficult cases.

In internal version there is danger of uterine rupture and increased risk of sepsis. Rapid extraction following version increases the danger of laceration and also of shock.

*To the Child.*—The dangers to the child in internal version are possible fracture of the bones, compression of the spine, and the usual risks of ordinary breech-birth.

**Operation.**—Most essential is an exact knowledge of the capacity of the pelvis, the size of the foetal head, and the

presentation and position of the foetus. Make a thorough examination after the patient is anæsthetized. For internal version the passages must be fully dilated or easily dilatable. If immediate delivery is intended the usual preparations for a breech extraction should be made. The operation is best conducted on a table. Two assistants beside the anæsthetist should be had if possible.

#### A. External Version.

External version is applicable, as a rule, only before labor. It is permissible when it can be done without violence.

**Method.**—Placing the hands upon the abdomen, one over each foetal pole, the poles are pushed in opposite directions. The manipulation is practised between the pains. During the pains the foetus is held to prevent reversion to the former presentation. Finally, after the version is complete, a binder and lateral compresses are applied over the abdomen to prevent recurrence of the malpresentation.

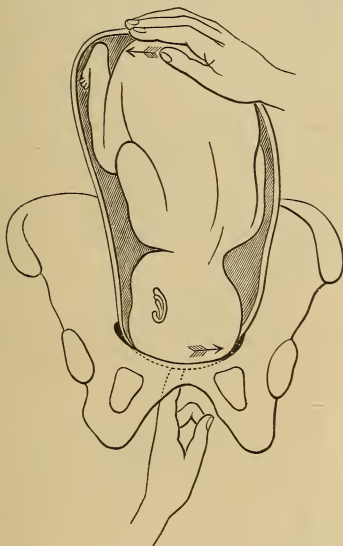
#### B. Bipolar Version.

Advantages of the bipolar over internal version are : A minimum of traumatism and shock ; less danger of infection. The fact that it may be done early in the first stage of labor is a distinct gain in placenta prævia. The bipolar should be preferred to the internal method when practicable.

**Method.**—As a rule anæsthesia is necessary. The bladder and rectum must be empty. The patient is placed in the dorsal recumbent position. The manipulation is conducted between the pains. A strict asepsis is imperative. One or two fingers of one hand are passed through the cervix, and the other hand is placed over the opposite foetal

pole externally. With the external hand the breech is pushed toward the side on which the feet lie. (Fig. 72.)

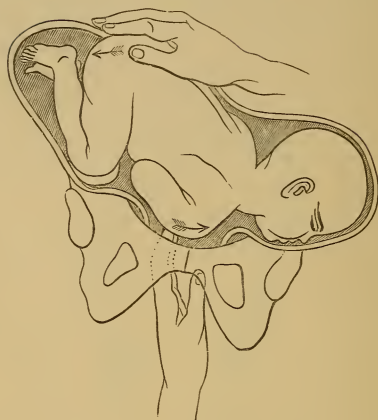
FIG. 72.



First stage of bipolar version. Elevation of the head and depression of the breech. (After BARNES.)

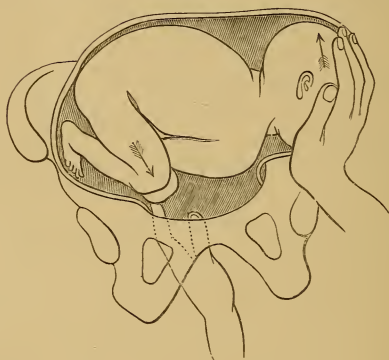
With the internal hand the head is tossed out of the excavation into that iliac fossa toward which the occiput points (Fig. 73); the trunk is pushed along in the same direction, inch by inch, till a knee presents. (Fig. 74.) The knee is drawn down and the foot extracted. (Fig. 75.) The other foot also may be brought down if easily accessible. The

FIG. 73.



Second stage of bipolar version. Elevation of the shoulder and depression of the breech. (After BARNES.)

FIG. 74.



Third stage of bipolar version. Seizure of the knee and partial elevation of the head. (After BARNES.)



labor is henceforth to be conducted as in spontaneous breech cases. The operator should cease manipulation during uterine contractions.

A bipolar manipulation is applicable in cephalic version also.

FIG. 75.



Fourth stage of bipolar version. Drawing down the legs and completion of version. (After BARNES.)

### C. Internal Version.

**Method.**—The patient is placed in the dorsal recumbent position under an anæsthetic. In difficult cases the knee-chest or the Trendelenburg position may be utilized.

The clothing of the operator is covered with a sheet or operating gown. The passages, their approaches, and

the operator's hands must be surgically clean. The operator should wear rubber gloves with gauntlets.

One hand is passed into the uterus over the abdomen of the child, palmar surface toward the child. Either foot or both feet are seized and the foetal ovoid is inverted by traction. If a hand is within reach it is snared and held down sufficiently to prevent extension. A prolapsed arm should be pushed above the brim. The other hand of the operator may be used externally to steady the fundus or to assist the rotation of the child by pushing up the cephalic pole. The operator relaxes the hand and desists from manipulation during the pains. To prevent cramping of the hand the manipulations should be carried out with the least possible muscular effort.

The completion of the birth is managed as in ordinary breech extractions.

## OBSTETRIC SURGERY OF THE ABDOMEN.

### CÆSAREAN SECTION: CÆLIO-HYSTEROTOMY.

**Definition.**—Cæsarean section is an operation for extraction of the child by section of the abdominal and the uterine walls.

**Historical Note.**—This operation antedates the Christian era. The earlier Cæsarean sections, however, were post-mortem operations done a few minutes after the death of the mother to save the child. The earliest Cæsarean section upon the living subject of which we have any knowledge was performed in the year 1500.

**Capabilities of the Modern Operation.**—Timely operations under the modern (Sänger) method and in favorable conditions should save not less than 95 per

cent. of the mothers, and the chances for the children should be as good as in spontaneous births. The maternal mortality is very great in operations delayed till the woman is exhausted by long labor and by attempts at delivery by other means, especially if exhaustion is complicated with sepsis. The foetal death-rate also is increased in late operations.

**Indications.**—With a living and viable foetus, the woman in operable condition, the head being of average size, Cæsarean section is indicated in flattened pelves, when the conjugate is below 7 cm.,  $2\frac{3}{4}$  inches, and in other forms of contraction in which there is equivalent disproportion between the head and the pelvic space; generally with dead foetus, when the conjugate is below 6.3 cm.,  $2\frac{1}{2}$  inches, and in cancer of the cervix, when delivery per vias naturales is impracticable.

In lesser grades of obstruction Cæsarean section may be chosen in preference to its alternatives, symphysiotomy, induced premature labor and even very difficult delivery by forceps or version if all conditions are favorable.

When the degree of obstruction is such that the delivery of a living child is impossible by other means, 7 cm. or less, *c. v.*, the indication is said to be *absolute*. When other operative methods are practicable in a given case, and the Cæsarean operation is elected, it is said to be done on the *relative* indication.

It would be better if the upper limit of the absolute indication were advanced to 7.5 cm. in simple flat pelves and to 9 cm. in generally contracted pelves as Whitridge Williams suggests.

The preferred time for operating is a few days before the expected date of labor. Operation at an appointed time

before labor permits better preparation, the patient's condition is better, the uterus retracts as well as in operation during labor, and drainage is all-sufficient or can be made so. There is a distinct advantage in operating before rupture of membranes since there is less traumatism, the child is more certainly viable and extraction is easier.

**Preparatory Measures.**—If necessary, the patient's strength should be reinforced by tonics and hygienic measures. The bowels are thoroughly opened the day before operating.

The bladder should be emptied and the rectum washed out immediately before the operation.

Instruments should be sterilized by boiling for ten minutes in  $1\frac{1}{2}$  per cent. solution of washing-soda.

The hands and arms of the operator and assistants should be sterilized and their clothing covered with operating-gowns which have been steamed for a half-hour immediately before using. Operator, assistants, and nurses wear muslin caps fresh from the steam-chamber to cover the hair.

The abdomen is prepared as follows: On the evening before operation, after a total bath and a change of linen—

Cover the entire abdomen with a green soap dressing for three hours;

Scrub ten minutes with a soft, sterile brush, green soap and hot water;

Shave the entire surface with a sterile razor;

Re-scrub;

Flush with sterilized water;

Wash with alcohol, using a pledget of aseptic cotton;

Flush for five minutes with the mercurial solution (1:2000);

Cover all with a compress well wet with the mercurial solution, covered with oiled silk and held with a binder.

On the morning of operation the entire field is covered with a compress wet with Labarraque's solution 1 : 10 or a formalin solution 1 : 250, which is removed just before the first incision.

In emergency cases the antisepsis must be as complete as the limited time allows.

The temperature of the room should be 75° to 80° F.

The patient is placed in the horizontal position and the body and extremities are wrapped warmly with clean flannels, except the operative field. The clothing about the field of operation is covered with dry cloths or towels sterilized by steaming for half an hour, and finally a sheet fresh from the steam chamber and provided with an opening to expose the field of operation is spread over the patient and top of table.

A sheet of Murphy's adhesive rubber dam over the entire abdomen next the skin is a valuable precaution against infection. The incision is made through it.

**Assistants.**—The first assistant stands on the left of the patient, opposite the operator. Another gives the anæsthetic. A nurse or third assistant takes charge of the steam sterilizer and the instruments. Another assistant stands ready to receive the child.

**Instruments.**—Scalpel; straight scissors; two thumb-forceps; six to twelve hæmostatic-forceps; needle-holder and needles; long catch forceps for holding sponge compresses; a large, thin-walled rubber tube, 1.25 meter (about four feet) long, as a constrictor for the neck of the uterus; a steam sterilizer for sterilizing cheese cloths, towels, etc., twelve No. 3 catgut sutures for the deep

uterine suture ; twelve No. 1 catgut sutures for the superficial uterine suture or a single continuous suture ; a plain continuous 00 catgut suture for suture of the parietal peritoneum ; twelve silkworm-gut sutures for deep abdominal sutures ; twelve plain No. 3 catgut sutures for closing the fascia or a single continuous catgut 18 inches long ; several dozen gauze compresses to be used for sponging.

**Summary of the Conditions of Success.**—The elective operation ; a perfectly aseptic technique ; deep uterine sutures, three to the inch ; superficial or half-deep between the deep sutures ; maintenance of the natural temperature of the abdominal contents ; the least possible handling of peritoneal surfaces ; operation within thirty to forty minutes.

**Steps of the Operation.**—1. Median incision of the abdominal wall ;

2. Application of the uterine constrictor about the lower uterine segment or manual control ;

3. Median incision of the uterus ;

4. Extraction of the child and placenta ;

5. Closure of the wounds and application of the abdominal dressing.

**Technique of the Operation.**—The operator assures himself that there is no loop of intestine between the uterus and the abdominal wall, beneath the field of incision. Should a coil of intestine be found here it is pushed above the fundus.

An assistant holds the uterus in central position. The skin incision extends from just below the navel to a point an inch above the symphysis, uncovering the linea alba. The tendon is divided, exposing the subperitoneal fat. Should the incision miss the linea alba and enter one of

the rectus muscles, separate the muscular bundles with the scalpel handle, pick up the fascial layers beneath with the forceps and divide them down to the retro-peritoneal fat. Bleeding vessels are held by catch-forceps or ligated before opening the peritoneum. The fat is pushed aside and the peritoneum lifted with thumb-forceps and nicked with the scalpel or scissors close to the forceps, and the incision extended to nearly the full length of the first incision on the finger as a guide. An assistant injects into the thigh hypodermically 5ss of fluid extract of ergot.

A loop of the constrictor is passed over the fundus and adjusted around the cervix; it is tightened only as necessary to control hemorrhage; or the constrictor may be dispensed with, the assistant encircling the lower segment of the uterus with his hands and using compression as required for the prevention of bleeding.

A short longitudinal median incision is made in the uterine wall well above the retraction ring, avoiding the membranes if still unbroken. This is lengthened upward with the fingers or scissors to a point short of the fundus. The length of the uterine incision should not exceed 15 cm., 6 inches.

The hand is thrust through the membranes and the child extracted by the head or the feet.

In case of anterior implantation of the placenta, it is separated at one edge and pushed aside, or the hand may be passed directly through it.

The cord is clamped at two points with catch-forceps, cut between them, and the child is passed to an assistant.

The uterine incision may be made at the fundus in the sagittal plane (Müller) or transversely extending between



the Fallopian tubes (Fritsch), but these incisions offer no material advantage.

If the uterus slips out of the abdomen the intestines are kept back, if necessary, with hot sterilized towels placed over the upper part of the incision. The coverings help also to protect the peritoneum from soiling. The uterus is wrapped in hot moist cloths.

The placenta, if not spontaneously separated, is peeled off by grasping it with one hand like a sponge. If the cervix is not sufficiently open for drainage it is dilated instrumentally or manually.

Irrigating or mopping the uterine cavity is unnecessary. Asepsis is promoted by leaving it as nearly as possible untouched. Irritating the peritoneum by handling, needless sponging, or contact of chemical antiseptics should be avoided.

The uterine wound is closed with deep No. 3 catgut sutures at intervals of 1 cm., about  $\frac{1}{3}$  inch. They are entered 1.3 cm.,  $\frac{1}{2}$  inch, from the incision and passed obliquely inward, falling short of the decidua.

The peritoneal coat of the uterus is closed with interrupted sutures of No. 1 catgut between the deep sutures dipping into the muscular coat, or a continuous suture may be preferred.

Remove the constrictor and secure retraction of the uterus, if necessary, by manipulating it through a hot towel or by faradism. Pull down the omentum over the uterus.

If liquor amnii or much blood has escaped into the peritoneal cavity, it should be removed completely by gentle sponging. When there has been much blood-loss a quart or two of warm sterilized 0.7 per cent. salt solution may be left in the peritoneum.

The parietal peritoneum is closed with a plain running No. 00 catgut suture.

Interrupted silkworm-gut sutures are then passed at intervals of 2 cm., about  $\frac{3}{4}$  inch, through all but the peritoneum from within outward.

The fascia is brought together with interrupted No. 3 plain catgut sutures, the skin may be closed with a running cutaneous or a subcuticular suture of plain catgut. Usually no special skin suture is required.

The silkworm-gut sutures are now tied. The abdominal wound is dressed with several thicknesses of dry sterilized cheese-cloth held in place by an abdominal binder.

**After-Treatment.**—To promote reaction the bed is warmed with hot-water bags, and the patient's head is wrapped in flannel; an injection of whiskey  $\mathfrak{z}$ ij or black coffee  $\mathfrak{z}$ iv and hot water  $\mathfrak{z}$ viii, may be given by the rectum if required.

An eighth grain of morphin or twice as much codein may be given subcutaneously in case of much pain or restlessness. As a rule this should not be repeated and none is needed after the first night.

The bladder should be emptied every eight hours, but the catheter should be withheld if possible.

The child is put to the breast as in normal cases. Two teaspoonfuls of hot water may be given every hour.

**For the Mother.**—Feeding is begun with light liquid food as soon as it can be retained, within twelve to twenty-four hours usually.

The bowels are opened with salines on the second or third day after operation, sooner should evidence of infection appear.

The silkworm-gut sutures are removed by the fourteenth day.

The patient can usually leave the bed at the end of three weeks. A firm abdominal binder or supporter should be worn for two or three weeks after operation.

**Post-mortem Cæsarean Section.**—In case of sudden death of the mother in the last month of gestation, the child usually may be delivered alive by abdominal section, if extracted within five minutes after the mother's death. It is stated on good authority that in exceptional instances the child may survive in utero for several hours after death of the mother. The child is saved in only about 5 per cent. of post-mortem Cæsarean sections.

#### **PORRO OPERATION: CÆLIO-HYSTERECTOMY.**

**Definition.**—A Cæsarean section, supplemented by supravaginal amputation of the uterus and removal of the tubes and ovaries.

The operation is named after Edward Porro, of Pavia, Italy, who was first to perform it, in 1876. The results in equally favorable conditions should not fall much short of those attained in simple Cæsarean section.

**Indications** are myomata of the uterus ; disease of the uterus or appendages requiring their removal ; marked puerperal osteomalacia ; probable uterine infection ; uncontrollable hemorrhage after Cæsarean section ; vaginal atresia obstructing drainage.

**Steps of the Operation.**—Abdominal incision, as in Cæsarean section ; eventration of the uterus ; constriction of the cervix with a finger-thick rubber tube, passing loop over the fundus, the ovaries and tubes being held up ; packing hot cloths about the cervix to keep blood and liquor

amni from soiling the peritoneum ; incision of the uterus and extraction of child and placenta ; transfixion of the cervix by passing two or three knitting-needles or hat-pins at different angles through the constricting rubber-tube and the cervix ; amputation of the uterus 2 cm.,  $\frac{3}{4}$  inch, above the constrictor ; ligation of the uterine arteries in the stump or at the sides of it ; stitching the entire circumference of the stump in the lower angle with the free surfaces of peritoneum in contact ; suture of the abdominal wound ; mummification of stump with perchloride of iron solution ; abdominal dressings as in Cæsarean section.

This operation is practically superseded by the usual modern method of supravaginal amputation. The technique, after the uterus is evacuated, does not differ from that of abdominal hysterectomy as done for fibroids. The after-treatment, too, is the same.

### SYMPHYSIOTOMY.

**Historical Note.**—Division of the pubic joint for the purpose of facilitating delivery in narrow pelves was first done on the living woman in France by Jean René Sigault in 1777. Meeting partial acceptance for a time, the operation, after a half century, had become practically obsolete. Revived by Morisani, of Naples, Italy, in 1866, it was taken up in the country of its birth by Pinard early in 1892. His success and advocacy led to its immediate adoption throughout the world.

**Results.**—The maternal mortality differs little from that of Cæsarean section under equally favorable conditions. The foetal death rate at the best is somewhat greater. The mortality for both patients, however, has been increased by operations performed on pelves too

small. Restoration of the symphysis, as a rule, is complete. Possible complications of the operation are laceration of the anterior soft parts, including the urethra and bladder, and hemorrhage, more rarely suppuration of the symphysis and injury to the sacro-iliac joints.

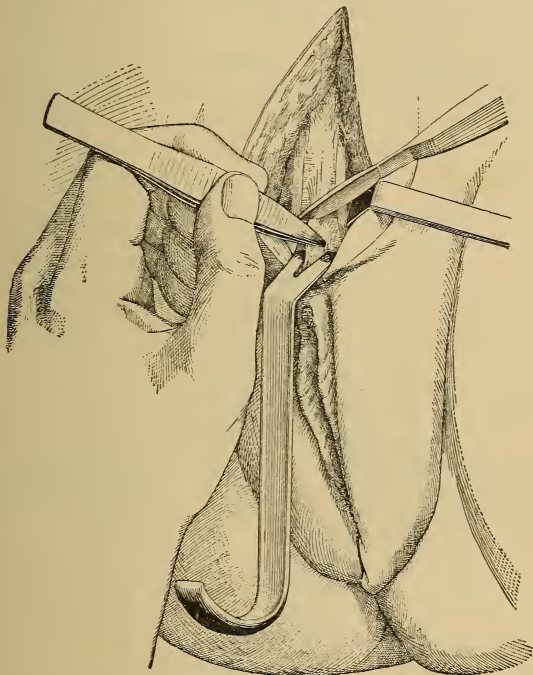
**Space Gained.**—The maximum pubic separation permissible, according to most authorities, is 7 cm.,  $2\frac{3}{4}$  inches; with an interpubic opening of that extent the conjugata vera gains a little more than 1.3 cm.,  $\frac{1}{2}$  inch. The transverse at the brim gains once and a half, the oblique about twice as much as the conjugate does. The parietal boss projects into the interpubic space, and this is equivalent to a slight additional increase in the conjugate.

**Indications.**—Simple flattening of the pelvis not below 7 cm.,  $2\frac{3}{4}$  inches, or better 7.5 cm., 3 inches, in the conjugate, or equivalent disproportion from other causes; irreducible occipito-posterior positions; firmly impacted mento-posterior face cases, and irreducible brow presentation. The operation is contraindicated in ankylosis of one or both sacro-iliac joints. The fœtus must be living and viable. With a dead or non-viable child craniotomy should be substituted.

**Method of Operating.**—The patient lies in the dorsal position, with the thighs strongly flexed and the knees held apart, under an anæsthetic. The antiseptic preparation of the abdomen is the same as for cœliotomy. The vulva and vagina are prepared with the same care as the abdomen. The cervix must be fully dilated. A metallic catheter is passed into the bladder by an assistant and pressed backward and to one side. This helps to protect the urethra and vesical neck from injury, and, at the

same time, keeps the bladder empty. The abdominal incision may be long or short. The long incision begins an inch above the top of the symphysis, and is carried

FIG. 76.



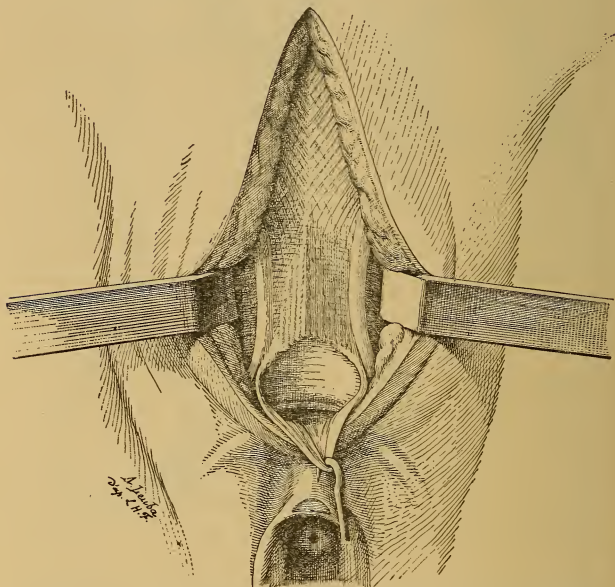
Incision in symphysiotomy by the open method; dividing the suspensory ligament of the clitoris. (FARABEUF.)

down over the anterior surface of the joint—the open method; the short incision is from one to three inches in

length, and terminates below at the top of the symphysis—the subcutaneous method. The advantage of the former is that the steps are conducted under direct inspection; it is claimed for the latter that the wound is less exposed to infection by the lochia. The open method is recommended.

In *the open method* the division of the joint is conducted as follows: The incision exposes the entire length of the joint, extends an inch above it, and opens the

FIG. 77.



Showing clitoris drawn down after division of its suspensory ligament, and the pubic arch laid bare. (FARABEUF.)



space between the recti muscles. The clitoris is drawn down with a sharp hook caught just above it, its suspensory ligament cut (Fig. 76), and the bony margin of the pubic arch laid bare by detaching from it the triangular ligament with a few strokes of the scalpel. (Fig. 77.)

The retro-pubic structures are pushed back with the finger passed down behind the symphysis, a broad strongly curved director is passed immediately behind the joint from below upward or from above downward. The clitoris and other vascular structures at the lower end of the symphysis are thus held back during the division of the joint. This prevents hemorrhage, which is otherwise sometimes a serious complication.

The joint is located by finding the notch at the top between the pubic bones or by forcibly flexing and extending one lower extremity while the other is held stationary.

The symphysis is then divided with a strong, slightly curved, blunt-pointed bistoury from behind forward or from before backward.

The bones are cautiously separated and held apart to the extent of 7 cm.,  $2\frac{3}{4}$  inches, the lateral halves of the pelvis being firmly supported by the assistants to prevent further separation as the head is forced down.

In the *subcutaneous method* the incision is from 2.5 to 7.5 cm., 1 to 3 inches, in length, according to the thickness of the abdominal walls, and it terminates below at the top of the symphysis. It is carried down between the rectus muscles. The finger is passed behind the symphysis, and the joint divided by the bistoury from behind forward and from above downward, the finger serving as a guard and a guide.

Venous hemorrhage, which is sometimes profuse, is controlled by pressure by packing the wound and, if necessary, the vagina with sterilized gauze or by hæmodynamic suture. The short incision may be extended should it become necessary for the control of hemorrhage or by reason of other complications.

When, owing to bony ankylosis or to the sinuous course of the symphysis, division with the knife is impossible, the joint may be opened with a metacarpal or chain saw.

The child is extracted with forceps if it is not promptly expelled by the natural forces. Bilateral episiotomy should be done, if necessary, to prevent laceration of the anterior soft parts at the vaginal outlet. Great care must be used during delivery to prevent laceration of the anterior vaginal wall.

After delivery of child and placenta, the bones are brought together firmly, the urethra and the vesical neck being meantime held backward to avoid pinching between the bones.

The soft parts are closed with silkworm-gut sutures, which, in the open method of operating, should include the fibrous structures in front of the joint. Two or three strands of silkworm-gut may be carried down from behind the joint as a drain. This is removed in twenty-four hours. Zweifel sutures the fibrous structures with catgut and leaves the superficial wound open for 8 or 10 days, packing it with gauze.

The pelvis is immobilized by means of two or three strips of rubber adhesive-plaster, reaching obliquely from one side of the pelvis to the other, above the wound, and over these a firm binder. The patient lies, moreover, during convalescence, on the back in a hammock-bed

(Ayers), or on two firm cushions which support the lateral halves of the body and the pelvis. A canvas binder provided with straps and buckles for fastening makes a firm and easily adjustable support.

An ounce or two of boric acid, 1 : 8, may be left in the vagina.

**After-treatment.**—For three or four weeks the patient should lie on the back with the limbs outstretched. The urine may need to be drawn with a catheter for the first two or three days after operation.

The binder is changed as often as soiled. The sutures are removed by the eighth or tenth day. The patient is kept in bed for four weeks. The binder remains six weeks.

### EMBRYOTOMY.

Embryotomy is the general term for all obstetric operations employed to facilitate delivery through the natural passages by lessening the size of the foetus.

**Indications** are hydrocephalus too large for safe extraction without perforating and not manageable by aspiration of the cranial cavity ; obstructed labor with a dead or non-viable foetus or a foetal monstrosity, conjugate exceeding  $2\frac{1}{2}$  inches ; and impacted shoulder or face presentation if the child is dead.

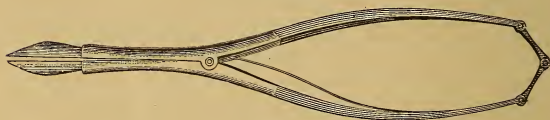
It is very rarely that embryotomy will be justifiable on the living and viable child. The sacrificial operation must be considered as an alternative of Cæsarean section or symphysiotomy when the condition of the mother is unfavorable for the latter operations, and especially if she elects the former with a full knowledge of the facts.

## CRANIOTOMY.

**Definition.**—An operation for the comminution and removal of all or a portion of the cranial bones to facilitate delivery.

**Steps.**—1. *Perforation.* The field of operation should be cleansed and disinfected and the woman placed on the table, in the obstetric position and under an anæsthetic. All but the operation field is covered with an aseptic sheet. The instrument may be a Smellie's scissors or Naegele's perforator (Fig. 78), preferably the trephine. In emergency a long, sharp-pointed surgical scissors will serve the purpose. The bladder and rectum should be empty. An assistant steadies the head by grasping it above the brim with the hands placed over the abdomen.

FIG. 78.



Naegele's perforator.

The point of the perforator is pressed against the head, perpendicularly to the surface of contact, just behind the pubic bones, the finger of one hand serving as a guard. Except when the trephine is used the puncture is best made through a suture or fontanelle.

The point is fixed in the tissues by a screw-like motion, and perforation is then effected by a similar motion.

The blades are separated in different directions to enlarge the opening.

The most approved method of perforating is with the trephine. It removes a button of bone, leaving a per-

manent opening through which the cranial contents may readily be evacuated.

The after-coming head may be perforated through a skin incision made at the base of the neck posteriorly; the perforator is passed subcutaneously.

The brain is broken up with the perforator and washed out with a stream of sterilized water forcibly injected with a Davidson's syringe.

2. *Comminution*.—With the craniotomy forceps passed within the scalp, the cranial bones are seized, one by one, and dislodged by rotating the forceps about its long axis and then removed. In moderate obstruction the head may be crushed and extracted with a cephalotribe.

In the higher grades of pelvic contraction the cranial base, as well as the vault, has been broken up. Tarnier's basiotribe was devised for this purpose. Between its blades is a screw perforator, which is made to perforate the head, while the blades crush it. With the resources of modern obstetric surgery basiotripsy is scarcely necessary.

3. *Extraction* is effected with the craniotomy forceps or, when space permits, with the cephalotribe, guarding carefully against laceration of the passages by projecting spicula of bone. If craniotomy forceps is used, one blade is passed within and one without the cranial cavity. In extreme narrowing the cranial base is best delivered edgewise by drawing down the chin.

### CEPHALOTRIPSY.

Cephalotripsy is an operation for reducing the size of the head by crushing the cranial vault. The best cephalotribe is Lusk's. (Fig. 79.)

The method of application does not differ from that of

the obstetric forceps. An assistant crowds the head firmly into the excavation if it is not already engaged. The head is perforated and the cephalotribe is applied with care to secure a good grasp.

The skull is then slowly crushed by turning a powerful screw at the handles. The head is brought down with the cephalotribe used as a tractor. Since the cranial vault is expanded in one direction as it is crushed in the opposite, care must be used to guard against laceration

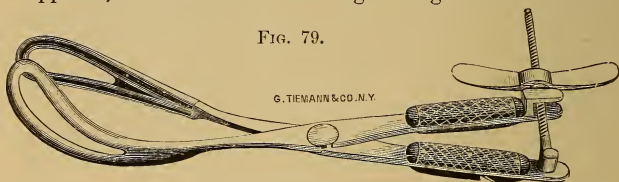


FIG. 79.

Lusk's cephalotribe.

of the passages by projecting spicula of bone. The elongated diameter of the head must be kept in the long diameter of the pelvis.

Cephalotripsy is practicable only in moderate contraction.

### EVISGERATION.

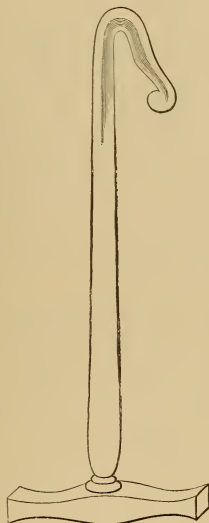
This term applies to all operations for reducing the size of the trunk by removal of its viscera. The operation is limited almost wholly to cases of impacted shoulder in which decapitation would be difficult or impossible.

Perforation of the trunk may be done with a craniotomy perforator, or through the bony coverings of the chest with the trephine. The viscera are then broken up with the perforator and removed with craniotomy forceps, with stout dressing-forceps, or with the fingers. The bony

walls, if necessary, may be cut away piecemeal with strong scissors.

Sometimes the trunk is divided into sections with a chain saw, or stout blunt scissors, and delivered piecemeal. The head is then crushed and extracted with the cephalotribe.

FIG. 80.



Braun's hook.

### DECAPITATION.

**Methods.** 1. *Blunt Hook and Scissors.*—While an assistant draws the neck firmly down with a blunt hook or a strong tape passed around the neck, the neck is gradually severed with blunt-pointed scissors guarded by two fingers of the other hand.



2. *Braun's hook* is a convenient and safe instrument for decapitation. (Fig. 80.) The hook is passed flat-wise on the hand as a guide. It is carried up between the head and the pubic bones till it can be hooked over the neck. The neck is then firmly engaged in the hook by traction. By a to-and-fro movement of the handle the neck is readily severed.

3. *Écraseur*.—A tape is passed around the neck as follows: It is first well oiled and knotted at one end; the knot is pushed up over one side of the neck with the fingers of one hand, the fingers of the other hand catching it and pulling it down on the other side. Another method of carrying the tape into place is with an English bougie properly curved and armed with a stylet. The chain of the *écraseur* is attached to the tape and drawn into place. The neck is then cut through by tightening the chain.

A wire *écraseur* armed with piano-wire or common picture-wire may be used for the purpose, or a chain saw may be substituted for the *écraseur*.

**Extraction.**—After decapitation the head is pushed up and the trunk delivered; then the head is extracted, chin first. Two fingers of one hand are hooked in the inferior maxilla and the head crowded through the pelvis by suprapubic pressure with the other hand or delivered with forceps or cephalotribe. In a narrow pelvis it may be necessary to crush the head before it can be delivered. Perforation may be done in the grasp of the cephalotribe and the cranial contents then be broken up and removed in the usual manner. Care must be taken lest the uterus be ruptured in these manipulations or the passage be lacerated by projecting bone-fragments.

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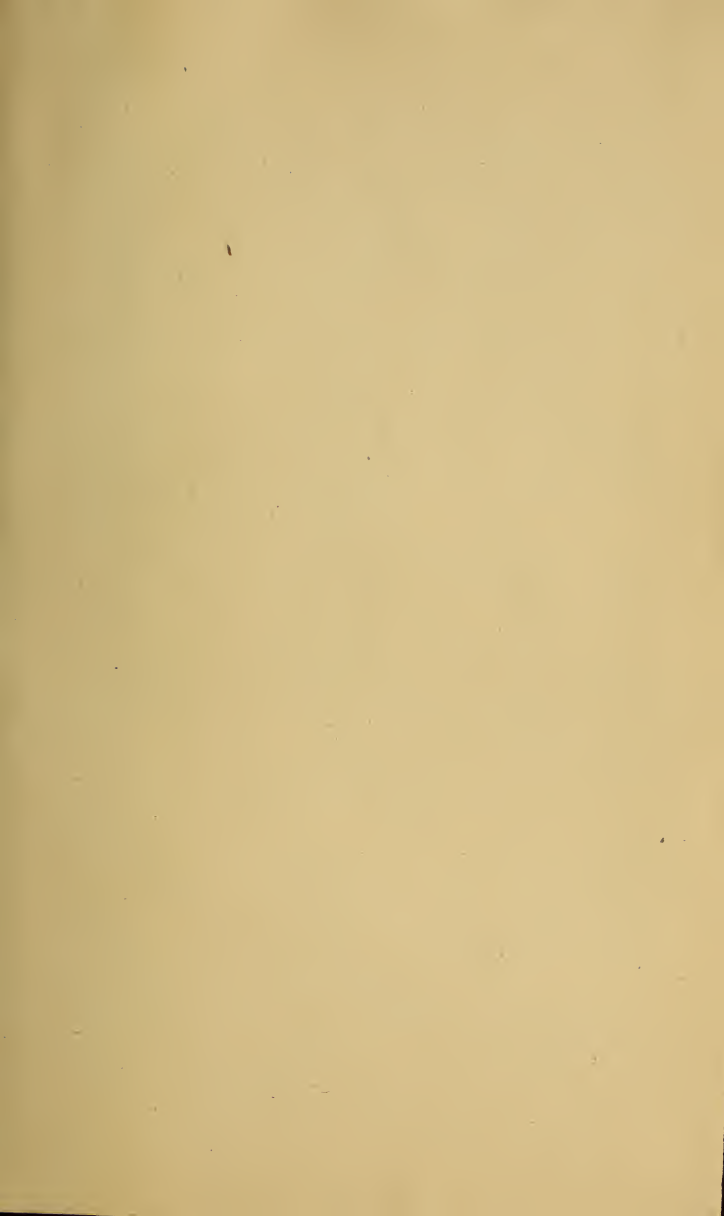
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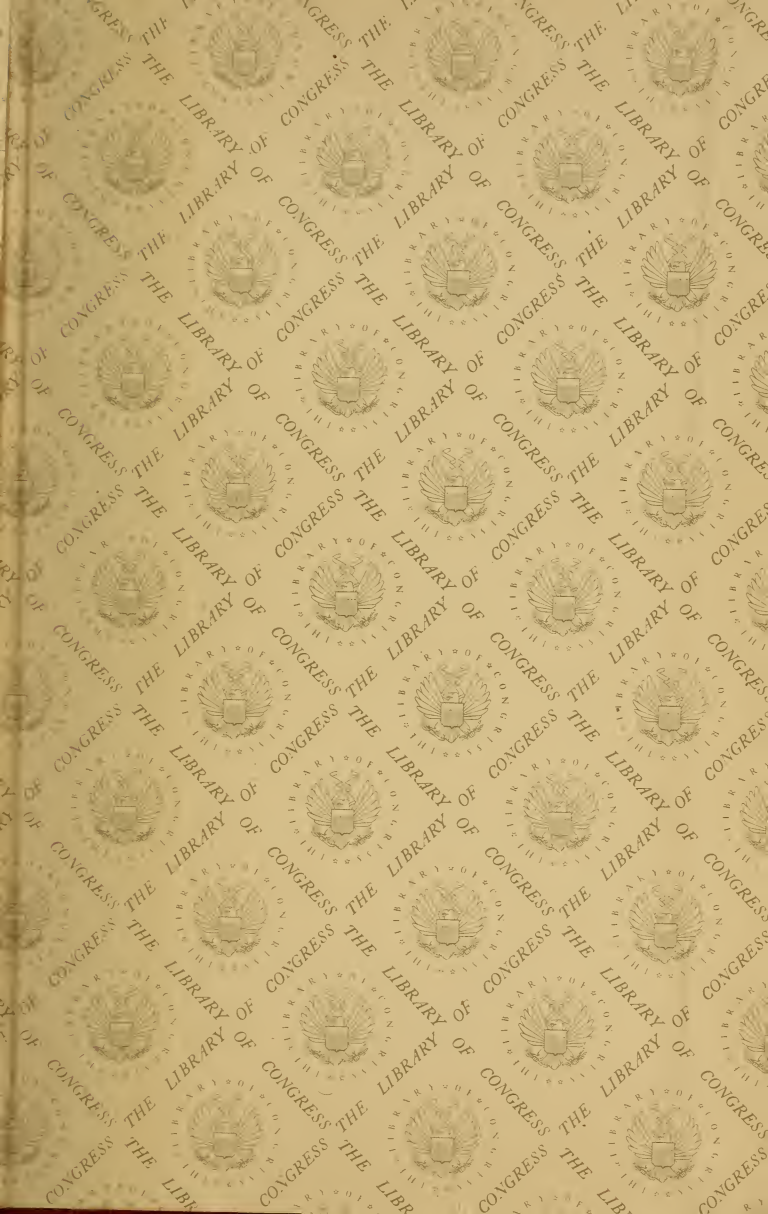
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